



PRESIDENCY UNIVERSITY

Private University Estd. in Karnataka State by Act No. 41 of 2013
Itgalpura, Rajakunte, Yelahanka, Bengaluru - 560064



**Incentives based Design for onboarding
Legal Service Providers such as Advocates,
Arbitrators, Mediators, Notaries, Document
Writers, etc on e-Market Place for
extending Legal Services to Citizens in
India**

A PROJECT REPORT

Submitted by

YASHAVANTH KS - 20221CSE0363

LANCHAN J - 20221CSE0325

MOHITH GOWDA J P - 20221CSE0328

Under the guidance of,

**Dr. B CHANDRASHEKAR
BACHELOR OF TECHNOLOGY**

IN

COMPUTER SCIENCE AND ENGINEERING

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PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

BONAFIDE CERTIFICATE

Certified that this report "Incentives based Design for onboarding Legal Service Providers such as Advocates, Arbitrators, Mediators, Notaries, Document Writers, etc on e-Market Place for extending Legal Services to Citizens in India" is a Bonafide work of "YASHAVANTH K S (20221CSE0363), LANCHAN J (20221CSE0325), MOHITH GOWDA J P(20221CSE0328)", who have successfully carried out the project work and submitted the report for partial fulfilment of the requirements for the award of the degree of BACHELOR OF TECHNOLOGY in COMPUTER SCIENCE ENGINEERING during 2025-26.

Dr. B Chandrashekhar Project Guide PSCS Presidency University	Dr. Jayavadiyal Ravi Program Project Coordinator PSCS Presidency University	Dr. Sampath A K School Project Coordinators PSCS Presidency University	Dr. Asif Mohammed Head of the Department PSCS Presidency University
Dr. Shakkeera L Associate Dean PSCS Presidency University			Dr. Duraipandian N Dean PSCS & PSIS Presidency University

Examiners

Sl. no.	Name	Signature	Date
1	Dr. ROJA B.A		28/11/25
2	Mr. Karthik.N.R		28/11/25

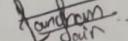
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ENGINEERING
DECLARATION

We the students of final year B.Tech in COMPUTER SCIENCE ENGINEERING at Presidency University, Bengaluru, named YASHAVANTH K S , LANCHAN J, MOHITH GOWDA J P , hereby declare that the project work titled “Incentives based Design for onboarding Legal Service Providers such as Advocates, Arbitrators, Mediators, Notaries, Document Writers, etc on e-Market Place for extending Legal Services to Citizens in India” has been independently carried out by us and submitted in partial fulfilment for the award of the degree of B.Tech in COMPUTER SCIENCE ENGINEERING during the academic year of 2025-26. Further, the matter embodied in the project has not been submitted previously by anybody for the award of any Degree or Diploma to any other institution.

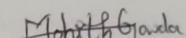
Yashavanth K S USN: 20221CSE0363

Signature 1: 

Lanchan J USN: 20221CSE0325

Signature 2: 

Mohith Gowda J P USN: 20221CSE0328

Signature 3: 

PLACE: BENGALURU

DATE: 28/11/2025

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YASHAVANTH K S

LANCHAN J

MOHITH GOWDA J P

Chapter 1

INTRODUCTION

In India today, access to justice is hampered primarily by the inability to pay the costs of attorney fee service fees. Legal services are frequently characterized by a lack of transparency and an inability to find reliable providers. The growing number of legal service offerings via online platforms provides an opportunity to provide an integrative online ecosystem that connects individuals with verified professionals (advocates, mediators, arbitrators, notaries, document writers). The proposed project is an incentive-driven, digitally created marketplace that will simplify the way individuals and companies discover, engage, and receive legal services from their respective service providers.

A system utilizing reputation-based incentives, reliable communication systems/electronic mail, and a simple service delivery process will enable increased access to affordable, reliable legal assistance for individuals and the public.

1.1 Background

The situation is that in India legal services are still very difficult to access today. The whole system is still on a very low level of organization and consequently, it is very fragmented. Legal service providers like advocates, arbitrators, mediators, notaries, and document writers are all working separately and no central platform or infrastructure exists. As a result, it is rather difficult for people to locate the right professional, check his/her qualifications, or even find out if the service provider gets the credit for the work done. The absence of a standardized pricing also contributes to the confusion and deterrence, especially among people from the economically disadvantaged section, who would otherwise be seeking legal support.

The government has run various initiatives such as Tele-Law and Nyaya Mitra, but their effects are still quite limited, particularly in rural areas where digital access and basic facilities are still lacking. This is why there is an urgent need for a legal service platform that is organized and driven by technology which would make professional onboarding for legal practitioners easier, guarantee equal access to justice, and foster transparency and trust among the citizens.

1.2 Statistics

The Indian legal system certainly encounters significant obstacles in providing justice that is fair and prompt, particularly to the poor and rural areas. As the India Justice Report 2022 points out, this is made worse by a lack of judges: only 21 per million people in India compared to the worldwide figure of 50 per million. This severe shortage is one of the major causes of the appalling situation of more than 50 million pending cases and keeps the public from getting justice quickly.

The regional disparities in the availability of legal services also continue to be stark. Thus, states like Bihar, Uttar Pradesh, and Madhya Pradesh retain extremely low lawyer-to-population ratios, making affordable legal assistance difficult to access. On the other hand, metropolitan cities like Delhi and Mumbai have an oversupply of lawyers, yet the cost of legal services there is often much too high for the average rural citizen.

According to the National Legal Services Authority, as many as 70% of Indians cannot afford legal representation, and rural communities are disproportionately affected. The World Bank adds that the problems also include a general lack of awareness, limited digital literacy, and inadequate outreach of legal aid services among rural populations in search of justice.

1.3 Prior Existing Technologies

In this respect, various government and private web-based platforms already exist with legal services for Indian and international clients.

1.3.1 Government Platforms

- National Legal Services Authority (NALSA)
 - Free legal aid is provided to economically weaker citizens.
 - Organizes Lok Adalats, that is, people's courts for speedy disposal of disputes.
- Nyaya Bandhu
 - Connects individuals with advocates willing to provide pro bono services.
 - Offers a mobile application for both lawyers and clients.

1.3.2 Private Platforms

- LawRato
 - An online directory with thousands of attorneys listed from over 700 cities.

- Matches users with lawyers based on location and specialization.
- VakilSearch
 - Focuses primarily on business-related legal services.
 - Assists with legal documentation, company registration, and trademark services.

1.4 Proposed Approach

Project Objective

The goal of the project is to have a centralized, reward-based e-Marketplace for legal services, which would include a variety of service providers like lawyers, mediators, arbitrators, notaries, and document writers. This e-Marketplace will serve as a medium to make the legal process more clear, cheaper and public access friendly while at the same time guaranteeing accountability for the legal service providers and the continuous improvement of the service quality.

Motivation

The inefficiencies in the Indian legal system can be mainly attributed to its high costs, inconsistent quality, and lack of trust. The majority of rural and underprivileged populations encounter severe problems when they want to access reliable legal services. The existing platforms almost never encourage participation by providing a reward-based model and thus, very rarely do they cater to the needs of the underserved areas effectively. This project fills the existing gap by coming up with a technology-driven platform that links the citizens with the trusted legal advisers and at the same time provides the service providers with incentives to do so by allowing them to give the best timely and quality service through the structured incentives.

Proposed Approach

The system is designed as a multilayered digital ecosystem consisting of:

1. Provider Verification
 - Verification of professional qualifications through integration with Bar Councils and other regulatory authorities.
2. Transparent Pricing Models
 - Clear, standardized pricing with a bundle of services to avoid ambiguity.
3. Incentives

4. Financial rewards, gamified badges, competitive leaderboards, subscription discounts backing every continuous participation.

5. Intelligent Matching Algorithm

Matches clients with suitable professionals based on expertise, location, language, and availability.

6. Access

Multilingual, with a mobile-first platform to increase adoption by the rural population.

Project Applications

1. Civilian use: The citizens can use it easily and can connect with the legal service provider easily without having to search for them.
2. Service provider: The service provider can use it easily; also, they can get their customer easily.
3. Legal Aid and NGOs: Offering low-income or subsidized services to communities of need.
4. Legal Education: Offers law students supervising casework experience.

Limitations of the Proposed Method

1. Digital Divide: Due to low population density with less developed data infrastructure and limited to low digital literacy, access to the proposed service is not possible.
2. Resistance from Traditional Practitioners: The established/ hiring solicitors or lawyers may not be interested in registering when they learn that they will be in competition with the registered learning providers for open access learning.
3. Privacy of Data: Sensitive and confidential information are safely kept only by encrypted advanced technology with regulation compliance.

1.5 Objectives

The project is built on the following clear and measurable objectives, each of which can be demonstrated through the developed system:

1. Behaviour

This would involve the design and implementation of an incentive-based participation model to monitor the behavior of legal service providers, including the grant of badges, rewards, and ranking based on timely service delivery, client rating, and general engagement.

2. Analysis

In order to develop the analytics module, which will be able to measure provider activity, service usage trends, and citizen satisfaction, statistical methods and data visualizations should be used in support of the platform performance evaluation and benchmarking.

3. System Management

To build an administrative dashboard that will support onboarding, credential verification of providers, service listing, and monitoring of client-provider interactions to effectively manage the system.

4. Security

In addition to protection tools, the use of strong identity verification methods is the necessity like JWT-based login, role-based access control, and encryption of the whole sensitive legal and personal data of the company, for example.

5. Deployment

The goal here is to develop and deploy a working model of the e-Marketplace using React to build the front end, Node.js with Express.js for the back end, and MySQL for the database.

1.6 SDGs



Fig 1.1 Sustainable development goals

SDG 16: Justice, Peace and Strong Institutions

The connection between the two is obvious since the SDG 16 is very much supported by the transparency and accountability that are offered through a platform where citizens can easily get in touch with verified legal professionals. The implementation of the platform is like a move towards building trust in legal institutions and promoting fairness and access in the distribution of justice since it allows standardized tracking of services and participation motivated by rewards.

SDG 9: Industry, Innovation, and Infrastructure

This endeavour aids the accomplishment of Global Goal number 9 by the digital marketplace for legal services that is not only secure and modern but also scalable. Besides, it is a milestone in the digital infrastructure of the legal sector which has enabled the entry of gamification, smart matching algorithms, and AI-powered incentives, the major reasons for raising the efficiency and dependability of legal service delivery, as the introduction of cutting-edge technologies.

1.7 Overview of project report

This report presents a comprehensive documentation of the project covering all aspects from conceptualization through implementation and validation.

Chapter 1 begins by establishing a solid context for the report's content with a full background of the problem domain. It includes relevant statistics concerning current access to legal services in India while discussing the experiences of people seeking "safe" and affordable legal solutions. The chapter discusses developments in existing technologies and platforms about digital marketplaces and online legal services. The chapter states the motivation for the proposed solution and the objectives of the project clearly. The chapter establishes how the proposed system relates to relevant United Nations Sustainable Development Goals (SDGs) and the societal benefits of the system. Chapter 2 makes a reference to the various journals and conferences that are related to digital marketplaces, incentive mechanisms and delivery of legal service.

Chapter 2 begins with a thorough analysis of journals, articles, conference papers, and other academic sources pertaining to digital service marketplaces, technology-driven dispute

resolution, incentive systems, and legal-service delivery models is given in Chapter 2. It examines prior research patterns, points out weaknesses in current systems, and emphasizes ideas that support the functionality and design of the system. This chapter serves as the theoretical framework for the suggested method.

Chapter 3 begins with the feasibility study, which looks at the system's operational, technical, and financial viability. It outlines the issue in detail and highlights the need for an organized online platform that links citizens with reputable legal experts. In order to create a clear specification that directs design and implementation in subsequent chapters, the chapter also describes the system's functional and non-functional requirements.

Chapter 4 begins with the system's overall design. Data-flow diagrams (DFDs), use-case diagrams, class diagrams, sequence diagrams, activity diagrams, and UML models are all included. Every diagram has an explanation that shows how various parts work together, how data flows through the system, and how the system guarantees scalable, safe, and effective operations.

Chapter 5 describes the implementation phase in depth. It outlines the technology stack used, such as frontend frameworks, backend technologies, database systems, APIs, and security mechanisms. The chapter then explains how each module of the system was developed, integrated, and tested during implementation. Any challenges faced and their corresponding solutions are also documented. This chapter wraps up the report giving an overview of the findings and some areas of future improvement.

Chapter 6 presents the usability, performance, security, and reliability testing conducted on the system. It includes detailed test cases, test procedures, and results demonstrating how the system performs under different conditions. The chapter evaluates whether the system meets the identified requirements and discusses improvements made based on test outcomes.

Chapter 7 reports the outcomes based on prototype demonstrations and user testing. It analyzes test feedback, system performance, and the effectiveness of the proposed incentive-driven framework. The chapter also interprets the results in relation to the project objectives and the problem statement, providing a meaningful discussion on the system's impact, limitations, and user experience.

Chapter 8 begins with concludes the report by summarizing the major findings and contributions of the project. It reflects on how effectively the system addresses the identified

problem and highlights the value it brings to users. The chapter also discusses potential areas for further improvement and future enhancements, such as additional features, scalability considerations, or AI-driven upgrades.

Chapter 9 compiles all references used throughout the report, following the appropriate citation style. The appendices include supplementary materials such as additional diagrams, wireframes, user interface mockups, user stories, sample datasets, and any supporting documentation that complements the main content, providing deeper insights into the system's design and development.

Chapter 2

LITERATURE REVIEW

The literature review addresses the difficulties in providing legal services in India, the situation of digital legal platforms around the world, and how incentives in service marketplaces can help to point out the gaps that need an incentivized e-Marketplace. The review is conducted through academic research, policy reports, and comparative studies to acquire a comprehensive understanding of the issue as well as the room for innovation.

2.1 Access to Justice in India

Access to justice has always been one of the major issues for the Indian government, scholars, and social reformers. Several studies suggest that a significant part of the Indian population in regions with low income or poor living condition cannot afford or access formal legal support.

A research paper from Harvard University concluded that 40% of rural India is not aware of the law and hence, can't seek judicial help, while another 30% stays behind for the reason of financial incapacity to pay for the lawyers' services [6]. The drastic variance in the taking up of legal services has been systematically recorded by legal aid reports published by NALSA and supported by policy recommendations from NITI Aayog [7].

Various types of barriers are there:

- Economic barriers: the absolute majority of the people do not want to engage with the judicial system due to the burden of legal costs and indirect expenditures related to justice that takes a long time to come.
- Geographical barriers: Most lawyers are present in big cities, while the country side and isolated places have little to no lawyers.
- Informational barriers: The utmost number of people are totally oblivious to the legal proceedings, their rights, and the available support services.
- Cultural and linguistic problems: This occurs when residents, especially those who speak in local dialects, cannot find attorneys of the very same practice area.

Even though the legal safeguards are already set, these systemic problems continue to bar access to justice for millions [8]. According to the data, the least and the most underprivileged

areas of society are experiencing big hardships in their quest for the reach and the use of a basic legal services system that is open to all.

2.2 Current Digital Initiatives in India

In order to improve access to justice, the government has taken some digital initiatives. Digitization of court systems through the e-Courts project is progressing, and Tele-Law connects citizens to panel lawyers through Common Service Centres. NITI Aayog's ODR Policy Plan emphasizes the use of technology to expand dispute resolution services [9].

However, analyses show some limitations:

- Their coverage is spotty, especially in rural areas.
- Most systems do not meaningfully integrate private legal professionals.
- There are limited incentive structures to ensure sustained high-quality service delivery.

These platforms do exist at a private level, but they are largely autonomous and often uncoordinated with regulatory systems, such as bar councils or legal aid authorities. Academic reviews have mentioned that without deeper institutional integration, these platforms cannot resolve structural access-to-justice challenges in any meaningful way.

At best, they represent important progress but mostly lack mechanisms to incentivize professional participation, ensure accountability, and integrate into the more general legal landscape.

2.3 Digital Global Legal Platforms

The digital legal-service marketplaces can be exemplified with the international ones, such as the US-based LegalZoom and the UK's Rocket Lawyer. These markets are basically centered around the creation of standardized documents, the automation of the routine processes involved, and the granting of legal support through a subscription model.

Nevertheless, these practices are pointing in the right direction but still the literature indicates that very significant adaptation is needed in the Indian context for a number of reasons such as:

- Major cultural and linguistic diversity
- Different levels of digital literacy

- More intricate regulatory requirements
- The necessity of strong provider verification in less-regulated environments

In addition, the Indian platforms have to connect the advisory services with litigation or dispute resolution—this connection is often more intricate when compared to Western jurisdictions. As a result, global best practices are very helpful but, at the same time, cannot be applied directly without major contextual adaptations.

2.4 Incentive Mechanisms in Service Marketplaces

Numerous digital platforms such as ride-hailing, freelancing, and home services have significant implications for understanding the motivation of providers and the means of quality assurance. The research illustrates that gamification features such as reward tiers, badges, and reputation scores produce a remarkable increase in service quality and, consequently, provider accountability.

The legal services sector is one where trust is absolutely necessary and so incentive systems cannot be based on quantity metrics. The effective models consider:

- Consumer satisfaction
- Speed of service delivery
- Ethical behavior
- Performance consistency

Examples of effective incentive tools include leaderboards, certification badges, priority lead allocation, loyalty tiers, and rewards for pro bono or community service work.

Yet, the literature advises that the incentive systems for professionals should be cautiously designed, as ill-designed incentives might eventually lead to encouraging providers to substitute quality with quantity, which is undesirable in legal services. Thus, an incentive model in a legal-service marketplace has to balance gamification with professional ethics, accountability, and service quality.

2.5 Gaps Identified

A critical review of related literature shows various important gaps that the proposed model has to fill.

First, India lacks an integrated digital ecosystem for reliably verifying, under one marketplace architecture, various categories of legal professionals such as advocates, mediators, arbitrators, notaries, and document writers.

Whereas there is no standardized system of fee transparency or fixed-price legal services, the ordinary user faces inconsistent pricing, with limited comparability between providers and uncertainty over what is a fair price.

Third, while incentive mechanisms have been highly effective in other service marketplaces, their application to date within the legal services sphere has been extremely limited. By and large, most current platforms do not use structured motivation mechanisms for the providers; such tools, though generally important, are even more so when engagement happens over digital platforms rather than traditional in-person or referral-based models.

Fourth, most of the present government-initiated programs are designed to provide legal aid for disadvantaged groups and do not include marketplace-type choice for the general population. As such, rural, marginalized, and multilingual communities remain underserved or poorly provided for.

Taken together, these gaps indicate that, while digital legal tools and policy frameworks exist, none combine the necessary component elements of:

- (a) an authenticated network of multi-specialist lawyers;
- (b) transparent pricing and incentive systems,
- (c) comprehensive, quality-linked provider motivational mechanisms, and
- d) Full involvement of marginalised groups.

In effect, the literature supports a clear and compelling need for an incentivized e-Marketplace for legal services in India. Drawing upon global best practices, solutions fitted to Indian socio-legal realities, and gaps identified, it is possible to evolve a technology-driven platform that can deliver not only improved access to legal professionals but also more transparent, efficient, and trustworthy justice outcomes.

Table 2.1 Summary of Literature Reviews

S#	Article Title, Published Year, Journal Name	Methods	Methods	Merits	Demerits
1	Designing Digital Marketplaces for Legal Services: Incentive Mechanisms and Governance Models” (2020, <i>Journal of Legal Technology and Research</i>)	Mixed-method approach (survey + game theory)	Proposes an incentive-driven governance model for digital legal marketplaces using reward-based participation.	Enhances participation of diverse legal professionals through structured incentive policies.	Limited to developed countries’ market models; lacks adaptation for Indian regulatory setup.
2	“Blockchain-based Smart Contracts for Legal Service Marketplaces” (2021, <i>IEEE Access</i>)	Blockchain integration & smart contract automation	Introduces blockchain to ensure transparency, authentication, and fair remuneration via automated smart contracts.	Improves trust, reduces fraud, and ensures transparency in fee distribution.	Implementation cost and technical literacy among legal practitioners remain barriers.
3	“Crowdsourcing Legal Expertise through Incentive Design in Online Platforms” (2019, <i>International Journal of Information Management</i>)	Econometric modelling & incentive analysis	Studies reward mechanisms and peer reputation systems for motivating experts to participate in online legal platforms.	Shows that non-monetary incentives (ratings, visibility) significantly increase engagement.	Focuses more on generic expert platforms, not specific to legal practitioners.
4	“E-Governance and Legal Aid Platforms: Policy Design and Incentivization in Developing Countries” (2022, <i>Government Information Quarterly</i>)	Policy analysis & stakeholder mapping	Explores incentive policies in government-run e-governance portals for onboarding public legal officers and mediators.	Demonstrates how tiered incentives improve service delivery and citizen access.	Limited longitudinal evaluation; lacks insights into private sector adoption.
5	“Adoption of Online Legal Service Platforms: Motivation and Barriers for Legal Practitioners in India” (2023, <i>Indian Journal of Law and Technology</i>)	Empirical study – survey of 250 practitioners	Investigates motivation factors, trust barriers, and expected benefits influencing adoption of legal e-marketplaces.	Provides localized insights into incentive and training needs in Indian context.	Study limited to urban regions; excludes rural and semi-urban practitioners.

Chapter 3

METHODOLOGY

3.1 System Architecture

The system architecture represents the core functional components that make up the proposed e-Marketplace platform. Each module plays toward seamless, secure, and efficient interaction between citizens and legal service providers. The major components include:

- User Registration and Profile Setup

It is the first point of entry for both clients and legal service providers, through which they can create accounts, set up profiles, and log into the site.

Configuration of the services, Lawyers articulate the services they offer, such as areas of experience, their pricing structures, their availability, and supporting documentation.

- Search and Discovery:

The module will allow browsing for and locating the best-fitting providers of a legal service, based on filters like specialization, location, language, experience, ratings, and price.

- Engagement of Provider and Request for Response:

The service requests are received by the provider from the customer and the whole process of replying in a good or bad way is controlled by him. Besides, it guarantees total clarity and monitoring of the customer-provider relations.

- Communication and consultation:

It allows clients and providers to communicate on case details securely via chats, calls, and video consultations. Also, they can share documents and coordinate the delivery of the service.

- Feedback and Ratings:

Allows customers to rate their experience and give feedback once the service is completed. This data leads directly to quality assurance and is also the basis for incentives on the platform among providers.

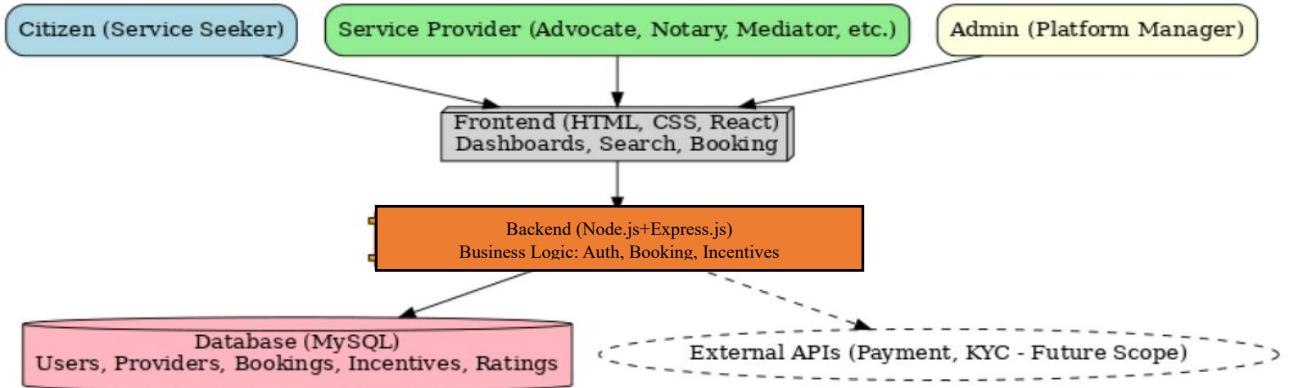


Fig 3.1 System Architecture Diagram

3.2 Modules

3.2.1 Citizen Module



Fig 3.2 Citizen Module Diagram

The citizen module is the main interface through which citizens access and interact with legal services on the platform. It is intended to be simple, intuitive, and user-friendly so that any individual, irrespective of his or her level of proficiency in digital literacy, can easily navigate it and connect with verified legal professionals.

This module will allow citizens to:

- Secure Registration and Login
 - Users create an account and verify identity to receive personalized services.
- Personal profile management
 - It allows users to edit their details, preferences, and list of starred service providers.
- Search and Filter Legal Professionals
 - Users can find an advocate, notary, mediator, arbitrator, and other service providers by filtering by specialization, location, service fees, experience, and user ratings.
- Book and schedule appointments
 - After finding an appropriate provider, the appointments can be requested by citizens while choosing available time slots.
- Make Simulated Payments
 - A mock payment system allows the user to proceed with the workflow of making a booking but actually enables safe, controlled testing during development.
- Provide ratings and feedback
 - Further, after a service is delivered, citizens can input ratings and written feedback, adding to the transparency of the platform and feeding into the provider incentive system.

The Citizen Module is, therefore, basically characterized by accessibility and ease of usage. This module facilitates the finding and approaching of trusted legal service providers, which in turn brings about more citizen participation and increases access to justice.

3.2.2 Service Provider Module

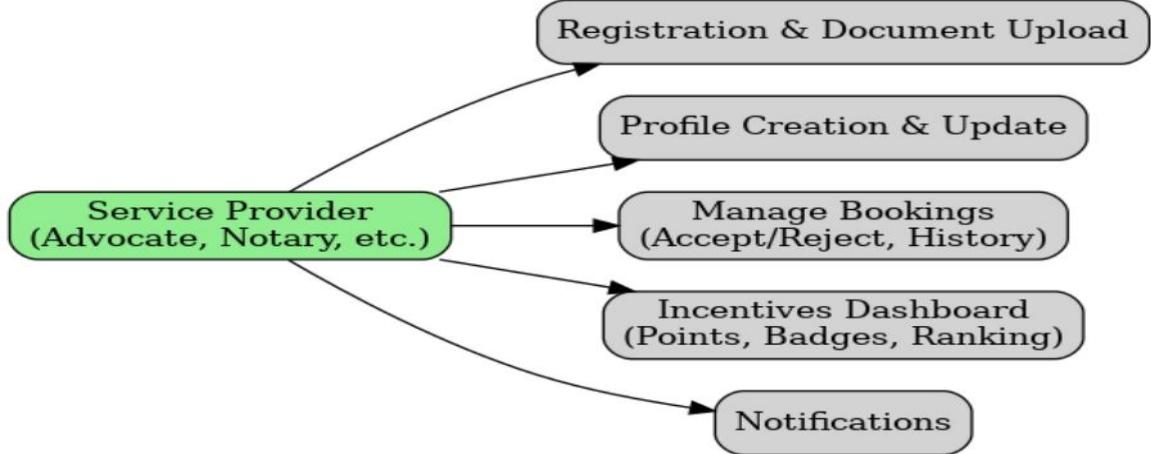


Fig 3.3 Service Provider Module Diagram

Service provider module: The needs of legal professionals who offer their services through the portal, including advocates, arbitrators, notaries, mediators, and document writers, are met by the service provider module. It gives the users a systematic interface where they can maintain their status as professionals, practice transparency and be in touch with the public in a nice way.

It enables service providers to:

- Uploads of Registration and Verification Documents
Lawyers will be able to sign up here and submit their credentials for review to ensure only verified, authentic providers are onboarded.
- Create and manage professional profiles
Providers can also edit information related to their specialisation, years of experience, fee structures for the services offered, languages known, and daily availability.
- Queryable Reservation Requests
Web-based scheduling allows providers to approve, decline, or reschedule the appointment requests of citizens within an integrated scheduling system.
- Access the Incentives Dashboard
Providers can view their total incentive points accrued, badges earned, ranking positions on the leaderboards, and performance measures based on their clients' satisfaction and quality of service rendered.
- Receive Notifications and Alerts

These include real-time notifications on new bookings, client feedback, verification updates, and messages from administrators.

In all, this module is important as it gives credibility, transparency, and motivation to the lawyers. The utilization of integrated incentives alongside verified profiles, and easy communication will result in legal service providers being constantly involved and their services being improved throughout.

3.2.3 Admin Module

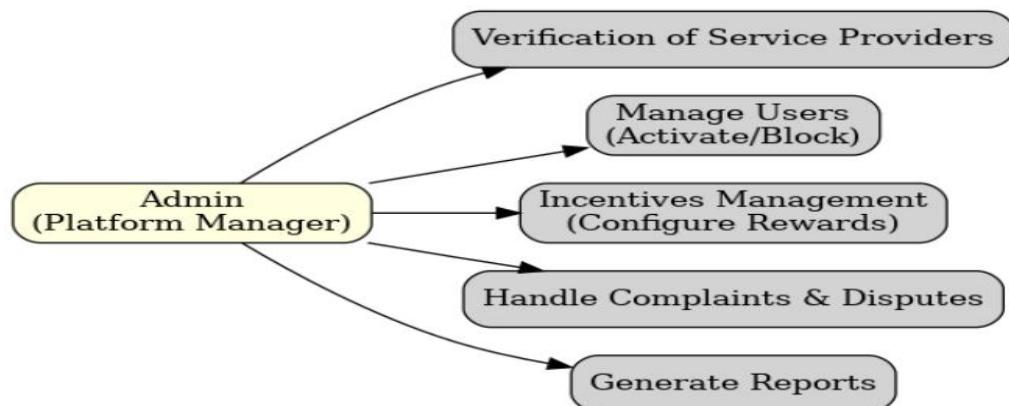


Fig 3.4 Admin Module Diagram

The Admin Module is the primary control centre of the e-Marketplace, allowing managers to access all areas of monitoring, managing, and keeping the platform clean. It guarantees that each engagement, service, and user operation is aligned with the platform's policies, quality standards, and legal requirements.

The administrator has the following rights:

- The admin can Check and Grant Permission to Service Providers

The admin goes through the documents and credentials that are uploaded to ensure that only licensed and legitimate lawyers are rendering services on the platform.

- User Accounts Management

The administrator can enable, disable, or lock users' accounts of both citizens and service providers in case of violation of the rules, inactivity, or security threat.

- The Incentive System Configuration and Monitoring

The admin can adjust the criteria for incentives, see the performance metrics of providers, and ensure that rewards, titles, and ranks are awarded in a correct and transparent manner.

- Complaints and Disputes Management

The module offers the administrators to scrutinize the grievances raised by the citizens or

providers and to undertake the steps necessary for problem resolution thereby making the area trustworthy.

- Reports and Analytics Generation

Administration can access very comprehensive analytics on the number of bookings, user participation, incentives, and the overall performance of the platform to back up decision-making with data.

In conclusion, the Admin Module ensures the security, credibility, and efficient management of the e-Marketplace and offers a digital ecosystem that is transparent and trustworthy for citizens and legal service providers.

3.2.4 Common/ Shared Module

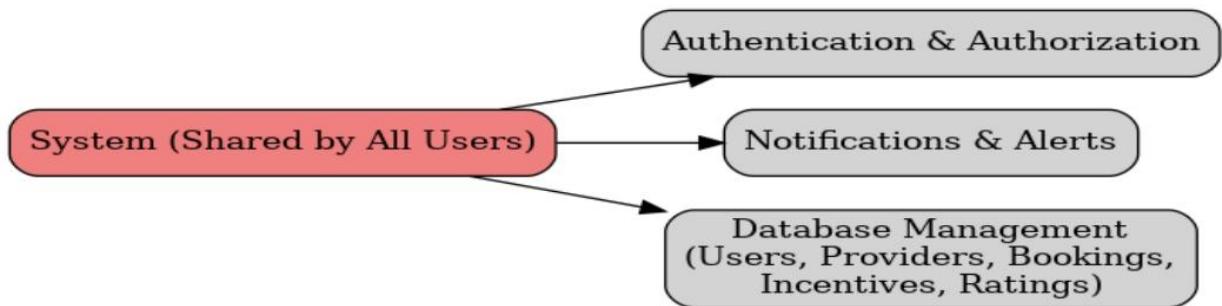


Fig 3.5 Common Module Diagram

The Common or Shared Modules are the e-Marketplace's foundational layer, and they not only support the other modules—Citizen, Service Provider, and Admin—but also provide essential system-wide functionalities. These shared services guarantee consistency and smooth communication with very secure data management throughout the platform. The main components are:

- Authentication and Authorization

It offers secure login mechanisms and role-based access control that allows citizens, service providers, and administrators only to access the features that are allowed to them. It thereby sustains the platform's security and also keeps user data safe.

- Notifications and Alerts

It provides real-time updates to all user types such as booking confirmations, feedback alerts, verification updates, and administrative notifications. This assures timely communication and increases user engagement.

- Database Management

It handles securely the storage and retrieval of all platform data such as user profiles, provider records, booking details, incentive transactions, and ratings. It also ensures data integrity, consistency, and accessibility in all the modules.

All the shared modules act as the backbone of the system, allowing communication to be reliable, coordination to be smooth, and operation to be efficient in all the functional components of the e-Marketplace.

Chapter 4

PROJECT MANAGEMENT

4.1 Project timeline

A well-structured and systematic approach of planning, organizing, and monitoring associated with each activity is a prerequisite for the effective completion of the project. The Gantt chart is the most important tool in project management for visually representing the flow of work during the entire period of the project. It shows the duration and the beginning and end points of every task, the degree of their concurrency, and their relationships in the sense of one task relying on another. This way, the project enjoys a very organized and on-time movement.

What the Gantt Chart Represents

- Activities:
All activities that are required to complete the system, from initial research to deployment.
- Timeline:
Distribution of project phases week by week allows for tracking progress clearly.
- Bars:
Visual indicators of the length and sequence of each task.
- Dependencies:
Activities that come before an event have to be the events themselves.

- Milestones:
I think checkpoints, such as project completions, design approvals, making prototypes, and research tests, are very appropriate.
- Progress Tracking:
The progress tracker keeps an eye on the plan vs. real comparison, finds out delays, and lets one know what area requires attention.

Project Planning Phase

Table 4.1 provides information, which includes:

- Understanding the problem domain
- Conducting a detailed literature review
- Finalizing the scope and functional requirements
- Designing the system architecture and preliminary modules

This phase lays the foundation for all subsequent development activities.

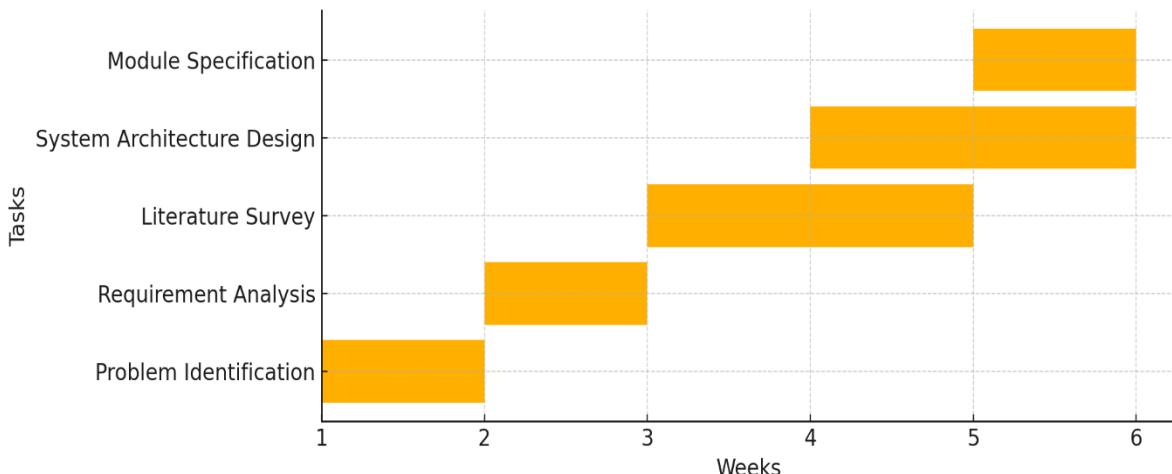


Fig 4.1 Project Planning Timeline

Project Implementation Phase

Table 4.2 provides information, which includes:

- Module-wise development
- Frontend and backend integration
- Testing and debugging cycles
- Documentation and report preparation

That is how all parts of the project work are carried out on schedule and efficiently.

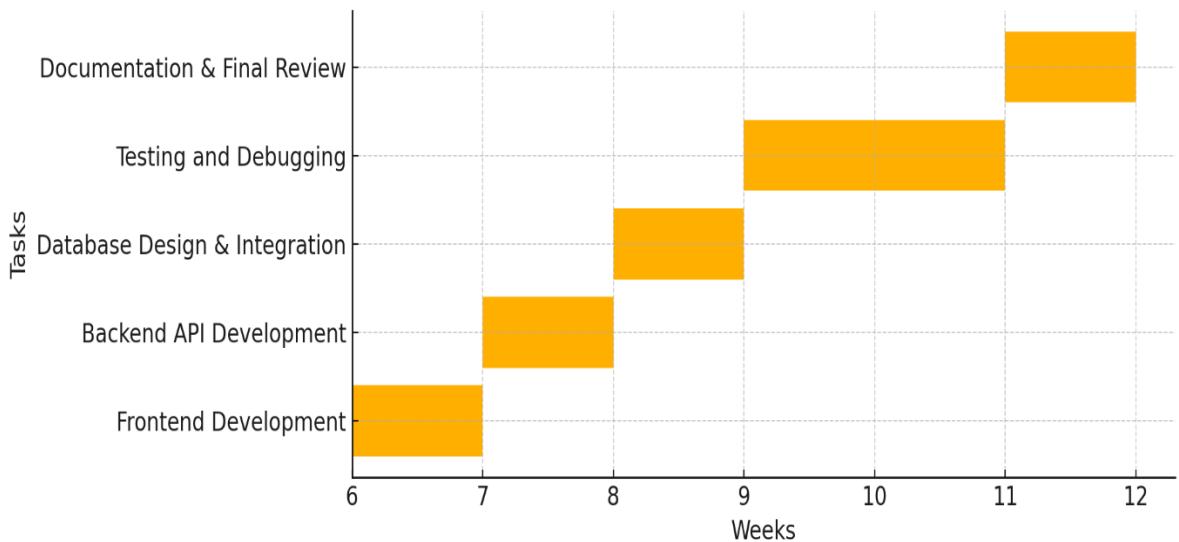


Fig 4.2 Project Implementation Phase

4.2 Risk analysis

Risk analysis is a crucial step to reveal the internal plus external factors which may influence the operation and success of the Incentives-Based Legal Service Platform. If such possible risks are recognized beforehand, then the project team can work on taking necessary measures that will allow for smooth implementation, reliable system operation, and the sustainability of the project in the long run.

A PESTLE analysis is conducted to review the various dimensions of risk, including Political, Economic, Social, Technological, Legal, and Environmental issues that may impact the project. This allows for a broader understanding of the wider environment in which the platform will operate.

A risk matrix is utilized to categorize, according to likelihood and potential impact, certain project-specific risks. The team will then adopt appropriate mitigation strategies through which disruptions may be minimized and the continuity of a secure and efficient functioning is assured.

Table 4.1 Example of PESTEL analysis

Political	Government regulations and policy changes	Platform must remain adaptable and compliant
Economic	Cost sensitivity among users and providers	Low-cost model encourages participation
Social	Low awareness & trust in digital legal systems	Requires transparency and user education
Technological	Need for secure data communication & uptime	Use encryption, stable backend, reliable hosting
Legal	Compliance with IT Act, identity verification	Verified onboarding and data protection measures
Environmental	No direct impact; promotes digital workflow	Reduces travel & paper usage (eco-friendly)

Table 4.2 Another example of PESTEL analysis

Political	Support for Digital India & e-governance	Boosts acceptance & alignment
Economic	Growing internet access affordability	Expands user coverage
Social	Demand for fair & accessible legal help	Platform builds trust and awareness
Technological	Better cloud & authentication tech	Enables secure remote consultations
Legal	Push for documented & transparent legal process	Improves credibility & reduces malpractice
Environmental	Shift to remote services post-COVID	Encourages digital workflows

Table 4.3 Example of Project phase risk matrix

Low provider participation	Medium	High	Offer incentives & verified profile benefits
User trust issues	Medium	High	Transparent rating and verification system
Data privacy risks	Low	High	Use encryption and secure access control
Performance under load	Low	Medium	Optimize backend and server scaling
Miscommunication	Medium	Medium	In-app messaging logs & clear status updates

4.3 Project budget

First and foremost, a project budget guarantees resource allocation of the best kind to each phase of the project; thereby, interference will not be caused to the project. The biggest chunk of the overall budget consisted of the operational and the documentation costs since the project

was executed by means of open-source tools and personal hardware. The following budgeting process consisting of six steps was adhered to rigorously.

Step 1: List All Tasks and Resources

The development tasks were recognized and their corresponding resources were determined.

The resources were as follows:

- Hardware (laptop, storage, peripherals)
- Software tools (all open-source)
- Internet usage
- Stationery and documentation materials
- Printing and binding requirements
- Miscellaneous costs (contingency)

Step 2: Check Team Availability

Each member of the project team had his/her own laptop and an internet connection. This enabled the team to be present for:

- Daily coding hours
- Weekly meetings
- Review discussions with the project guide

So, no extra hiring or external resources which resulted in no cost.

Step 3: Estimate Task Duration

Planning, designing, implementation, testing, and documentation were the activities each based on the following:

- Module complexity
- Team's previous experience
- Academic calendar limitations

This made it possible to employ resources in an efficient way without the need for overtime or extra salary payments.

Step 4: Use Your Experience and Data

Previous academic projects and guidelines from faculty members were used to refine cost estimation.

Historic data indicated that academic projects typically require:

- Printing costs
- Internet usage
- Stationery
- Minor contingency expenses

Open-source technologies significantly reduced costs.

Step 5: Set the Project Budget

All costs were consolidated into a final project budget.

Since hardware and software were already available, costs relate to operational and documentation needs only.

Open-source development = Zero software cost

Personal system usage = Zero hardware purchase cost

Step 6: Keep Track of the Project Budget and Assess the Team

Costs were checked periodically and matched against the estimated budget.

The team ensured that:

- Printing costs were optimized
- Internet usage remained within limits
- Contingency expenses did not exceed estimated values

The final budget remained within the academic guidelines.

Table 4.4 Summary table of the budget

Resource / Item	Description / Purpose	Cost (INR)
Laptop & Personal System (Existing)	Development, testing, and documenting purposes	0 (Already owned)
Internet Connectivity	Communication with the team, framework downloading and research	500
Software Tools (VS Code, Node.js, MongoDB, GitHub)	All open-source tools used	0

Cloud / Hosting (Local Testing Only)	Development server for local testing	0
Stationery / Printing / Notes	Documentation of notes, planning sheets and rough drafting	250
Final Documentation Printing & Binding	Color print + hard binding submission copy	350
Contingency Cost	Unexpected additional costs (transport/extr prints)	200
Total Estimated Cost		₹1,300 /- Only

The total project cost has been estimated at ₹1,300, which includes the essential operating costs and the costs of documentation. Besides, there is no issue with software licensing as the development tools such as React, Node.js, Express.js, MongoDB, and Visual Studio Code are free and open source. Team members already had the required hardware resources, like a laptop and internet connection, thus very little was spent. This fits the demands of academic projects and demonstrates a resource-efficient and inexpensive method of implementation.

Chapter 5

ANALYSIS AND DESIGN

This chapter captures the system's purpose, behaviour, and functional and non-functional requirements. It outlines both the hardware and software requirements essential for implementing the Incentives-Based Legal Service Platform.

5.1 Requirements

5.1.1 System Hardware Requirements

1. Initial Conditions

Citizens and Legal Service Providers (LSPs) must use a device—such as a smartphone or laptop—capable of running a modern web browser. A stable internet connection is required for both users and system operations. The platform’s infrastructure must be deployed on a reliable cloud environment.

2. Input Parameters

- Client-side: device type, browser version, screen resolution, and network speed.
- Server-side: CPU cores, RAM allocation, and storage capacity.

3. System Outcomes

The platform must maintain continuous high availability (99.9%) and support a fully responsive user interface that adapts to all common device sizes.

4. Relationship Identification

Backend server load is directly influenced by the number of concurrent active users. Therefore, the infrastructure must support elastic scaling, automatically adjusting resources (CPU, RAM) based on real-time traffic.

5. System Constraints

- Requires a dependable cloud service provider (AWS, Azure, GCP, etc.).
- Depends on users’ internet connectivity.
- Cloud hosting expenses will increase with system growth and higher usage.

5.1.2 System Software Requirements

1. Initial Conditions

A user—Citizen or LSP—accesses the web platform or future mobile application.

2. Input Parameters

- Citizen: Signs up with the platform and accesses legal services through their device.
- LSP: Registers by uploading the required verification documents and waits for approval by the admin.
- Admin: Reviews LSP documents, validates their credentials, and approves or rejects provider onboarding.

3. System Outcomes

- The result is a fully functional platform that:
- Provides affordable, accessible legal services to citizens.

- Creates employment for LSPs.
- The platform thereby resolves two major problems: inaccessibility of affordable legal support and lack of visibility or opportunity for service providers.

4. System Constraints

- Compliance: Should abide by the requirements of the Bar Council of India on advertisement and solicitation.
- Data Protection: Must comply with the Digital Personal Data Protection (DPDP) Act, 2023.

Table 5.1 Summarizing requirements

Purpose	The aim of the e-Marketplace development is not only to attract LSPs but also to make them provide legal services to the citizens of India that are accessible, transparent, and quality assured legally.
Behaviour	The application supports the two main user roles: Citizens and LSPs. Citizens can search for services and make appointments, as well as pay for them. LSPs can create authenticated accounts, present their services, and get rewards in the form of badges, points, and their position on the leaderboard based on their performance and service quality.
System Management	The remote monitoring, user support, dispute resolution, and analytics are part of the system management tool named the admin dashboard. The metrics in the system include LSP onboarding rate, citizen growth, service trends, and platform performance.
Data Analysis	Among other things, the advanced data processing of the system involves 1) running the

	incentive engine to set the rewards for LSP activity and 2) performing pricing trend, service demand, and user-provider mismatch analysis.
Application Deployment	The application will be installed on a cloud-based infrastructure that is both centralized and scalable (e.g., AWS or Azure) and will be accessed through a responsive web application. Native smartphone applications for iOS and Android could be future additions to the platform.

5.2 Block diagram

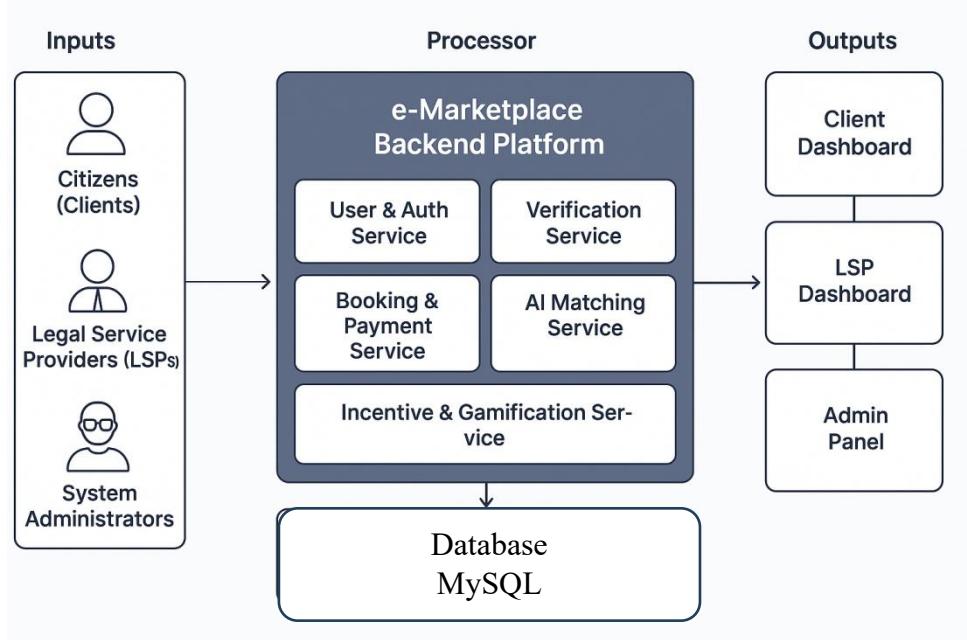


Fig 5.1 Functional block diagram

The functional block diagram illustrates how major components of the e-Marketplace interact in providing seamless services. It shows how information flows from the inputs of the system through the processing layer to the final outputs, supported by a centralized database layer.

Inputs (Left)

Three major actors access this system, namely:

- Citizens (Clients)
- Legal Service Providers (LSPs)
- System Administrators

All users interact with the platform via web and mobile applications, which serve as an entry point into the system.

Processor (Middle)

The e-Marketplace Backend Platform serves as the core processing unit, which has been created using a microservices architecture. In this case, the microservices are designed to handle a specific function which guarantees both modularity and scalability. The most important functional blocks of the system are as follows:

1. Consumer & Authentication Service

It handles user registrations and logins, credential verification, and management of the profile.

2. Verification Service

Manages the workflow process for new LSP approvals, which includes uploading documents, administrative review, and final approval.

3. Booking & Payment Service

Manages service listings, availability calendars, booking requests, and integrates with payment gateways.

4. AI Matching

Service Processes client inquiries and recommends the best LSPs, considering these factors: expertise, availability, location, and past performance.

5. Incentive & Gamification Service Activity monitoring of LSPs and management of respective reward mechanisms: points, badges, levels, leaderboard rankings.

Outputs (Right)

The following are the most important user-oriented outputs of the system:

1. Client Dashboard: It displays booking history, recommended LSPs, and it also includes AI assistant features that explain concepts or procedures to users in detail.
2. Dashboard LSP: It reflects earnings and incentive status, new client requests. Providers can upload documents and communicate with the clients.
3. Admin Dashboard: The admin has the ability to confirm LSP registrations, perform user activity administration, dispute management, and can see all operations going on in the platform.

Database Layer (Bottom)

A common database shared by all services is the one storing the information of:

- o Profiles of Users and LSPs
- o Proof of verifications
- o Reservations and receipts
- o Customer reviews and rewards
- o System settings and logs of audits

Therefore, this centralized storage makes the data across the platform to be consistent, secure, and easily retrievable.

Suitability of the Block Diagram

The block diagram fits perfectly to the system suggested because it:

- Divides the concerns into logically independent microservices
- Increases the scalability, where each service can scale according to demand
- Generates better maintainability, where one service (e.g., Incentive Service) can be updated without affecting another (e.g., Payment Service)
- Produces higher fault tolerance such that a failure of one service will not affect the whole platform

The architecture is thus overall supportive of the agile development, quick deployment, and the e-Marketplace's supporting of the long-term sustainability.

5.3 System Flow chart

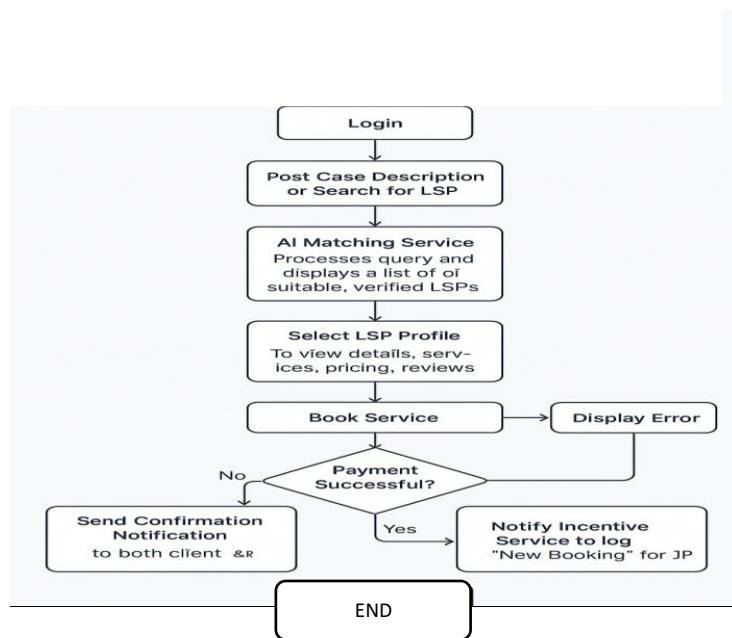


Fig 5.2 System flow chart

In the illustration of the Figure 5.2 the citizen's main workflow during the booking of a legal service through the platform is visualized. It uncovers everything from login to confirmation and shows the interactions of the system and the points of decision.

Flow Description

1. Client Login

The client logging into the platform with valid credentials is the first event in the process.

2. Case Description or LSP Search

The client can either post a case description or look for a Legal Service Provider by applying filters such as specialization, language, or location.

3. AI-Based Matching

The AI Matching Service for the system processes the query and provides a list of verified and suitable LSPs according to their relevance and availability.

4. Viewing LSP Profile

The client picks an LSP's profile for going through detailed information, which consists of services offered, transparent pricing, ratings, and past reviews.

5. Booking the Service

The client, after looking at the profile, clicks "Book Service" and then chooses an open time slot from the provider's calendar.

6. Payment Processing

The system takes the client to the payment gateway where they have to either pre-pay or confirm the booking.

7. Payment Verification (Decision Point)

The system is verifying whether the payment was executed successfully.

8. If Payment Fails

The client will see an error message, and the system will take him/her back to the payment screen for retrying.

9. If Payment Succeeds

The booking is considered to be confirmed.

10. Notification Trigger

A confirmation notification will be sent automatically to both the client and the LSP.

11. Incentive Logging

The Incentive Service will be alerted to log the "New Booking" thus adding to the LSP's points, badges, or leaderboard rankings.

12. End of Flow

The whole process of service booking has come to an end.

Suitability of the Flow Chart

This flowchart is quite suitable and beneficial for the reason that it:

- Illustrates the main value route of the platform—client connection with legal service providers.
- Recognizes system touchpoints such as searching, booking, and paying as organization's pillars.
- Indicates payment success or failure as a crucial operation area.
- Depicts the links to backend services, for instance, the AI Matching Service and the Incentive Engine.
- Provides a distinct comprehension of the “happy path” for both the users and the developers.

In summary, the flowchart offers a transparent and well-organized representation of the reservation process that is helpful in both the system design and the stakeholders' understanding.

5.4 Choosing devices

The entire software-based project aims at creating a secure, transparent, and incentive-driven e-Marketplace for Legal Service Providers in India. Thus, it does not need any physical devices like IoT devices, sensors, actuators, or microcontrollers.

Here, the word “devices” refers to computing resources—client devices, developer machines, servers, and cloud tools—that facilitate the deployment, access, and operation of the digital platform. These devices are responsible for the entire system operations from user interaction to back-end processing and AI-driven services.

Table 5.2 System Devices and Their Roles

Device Type	Examples / Tools Used	Purpose in Project	Key Features / Specifications
Client Devices (User Interface)	Laptop, Smartphone, Tablet	By the public, legal service providers, and admins to get to use the web application through a browser.	Modern browsers are supported (Chrome v100+), minimum of 4 GB RAM, internet speed greater than 1 Mbps.
Development Machines	Intel Core i5/i7 or AMD Ryzen 5/7	Used for development, testing, and local server setup for React and Spring Boot/Node.js running.	4–8 cores, minimum of 8 GB RAM, SSD storage greater than 250 GB.
Application Server	Cloud vCPUs (AWS EC2, Render, Railway, etc.)	Backend services (Spring Boot / Node.js) are hosted, API requests are handled, authentication is done, and incentive logic is processed.	2 vCPU, 4 GB RAM, SSD storage, and auto-scaling are enabled.
Database Server	MySQL / Cloud SQL Instance	Structured data is stored like user profiles, transactions, feedback, and incentive data.	ACID compliance, SQL support, and encrypted connections.
AI Integration Module	Google Gemini API	AI-powered suggestions and smart system feedback are offered.	Cloud-hosted service protected with API key and HTTPS.

Frontend Hosting	Vercel / Netlify / Firebase Hosting	The React-based frontend is deployed with worldwide CDN backing for quick delivery.	Deployment at the edge, builds are automatic, and HTTPS is mandatory.
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5.5 Designing unites

The system is divided into a number of well-structured functional units that would make it very easy to scale, modularize, and keep clear throughout the development process. Four distinct units—Citizen, Service Provider, Admin, and Common/Shared—have been established in the system architecture, each with its own unique responsibility, but very much connected by common backend services and the centralized database.

1. Citizen Unit

The Citizen Unit is the main user interface for the people who need legal services. The following design elements are incorporated in the unit:

- Frontend Design:

Made in React.js giving an easy-to-use and quick interface for registration, profile management, service searching, and booking.

- Backend Logic:

Created in Node.js and Express.js, dealing with authentication, search, booking, and feedback submission.

- Database Integration:

Information related to citizens is kept safely in the database and can be accessed when needed.

Key Components:

- UserDashboard.js – It takes care of registration, login, service browsing, and overall user engagement.
- Booking.js – These deals with the whole booking process including time slots and confirming appointments.
- Feedback.js – It enables the users to give ratings and offer their opinions about the services they have used.

2. Service Provider Unit

This unit is responsible for legal experts, such as attorneys, arbitrators, mediators, and notaries which means they can register with the platform and offer their services through it.

- Frontend Design:

It includes the features for creating a profile, uploading documents, listing a service, and interacting with the client.

- Backend Logic:

It is written in Node.js and Express.js and enables providers to chat with clients, cancel appointments, and manage payments and incentives.

- Database Integration:

The information about the providers, their verification papers, and their conversations are all kept in a place that is very difficult to get into and use but can be accessed when needed.

Key Components:

- ProviderDashboard.js – Controls the process of sign-up, managing the profile, listing services, and putting through the approval workflows.
- Feedback.js – Receives and processes feedback coming from citizens and then helps in the evaluation of the incentive score.
- DocumentVerification.js – Checks and confirms the credentials that were uploaded and then sends them for the approval of the admin.

3. Admin Unit

The Admin Unit is the heart of the platform, where all activities are monitored and the system's integrity is assured.

- Frontend Design:

A secure admin dashboard is part of the design and it gives access to analytics, verification panels, user management tools, and complaint-resolution interfaces.

- Backend Logic:

Role-based access control (RBAC) is applied to make sure that only the authorized admins can approve the LSP registrations, resolve disputes, or access the sensitive areas.

- Database Integration:

This is done through the use of tables meant for admin, verification, and reporting which allow the monitoring of the platform performance and user activities.

Key Component:

1. AdminDashboard.js – Makes decisions on user and provider approvals, does system monitoring, and takes care of escalations.

4. Common/Shared Unit

This unit is the core of the system that provides services to all other modules thus, bringing uniformity, safety, and effectiveness.

- Authentication & Authorization:

JWT token is the technique that assures a secure login and that only authorized users can access the API.

- Notification Service:

Booking, approval, and system update notifications are sent through email and the dashboard in real-time.

- Database management:

MySQL is the database of choice, and a normalized schema is used to ensure data integrity, reliability, and scalability.

Key Components:

- AuthService.js – Is responsible for login, session handling, and token validation.
- Config.js – Handles database connection, schema sync, and environment configurations.

5. Data Flow Overview

All units are linked through a central API layer and a shared MySQL database which guarantees efficient communication.

- Citizen Unit is used to send service requests
- Admin Unit checks provider credentials and approves profiles
- The requests are then sent to the Service Provider Unit for acceptance or action
- All interactions are recorded, controlled, and stored by the Common Unit
- This modular architecture facilitates trouble-free independent operation of each unit and thus, significantly increases the maintainability, extensibility, and scalability of the overall system.

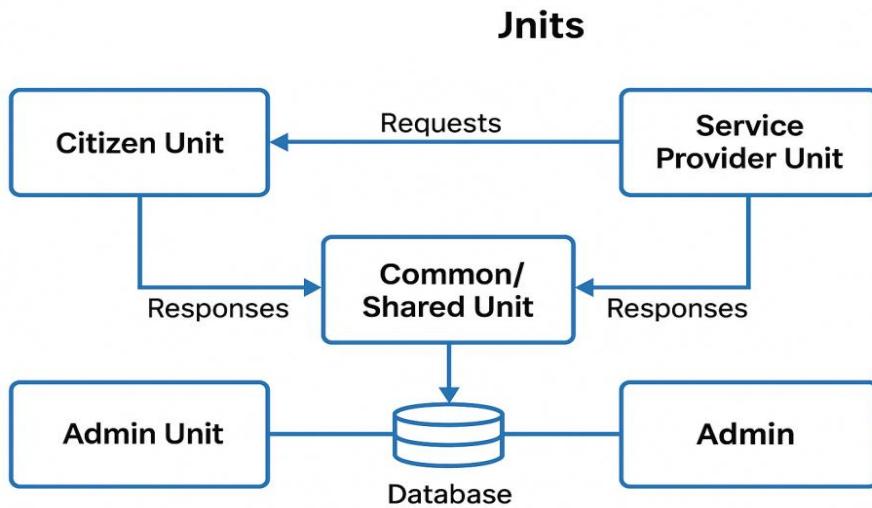


Fig 5.3 System Design Unit

5.6 Standards

The project has a strict adherence to certain standards and best practices that the quality of software development will be guaranteed. These standards contribute to the system's overall development lifecycle by providing the support of the system's reliability, maintainability, scalability, and security.

Programming Language Standards

- The back-end is implemented with Node.js and Express.js, and React.js is used for the front end.
- The coding styles are based on the mainstream JavaScript/Node.js style guides that give rise to a common practice in naming, indenting, and reading especially in terms of JavaScript and its related forms like Node.js.
- The practices of clear comments, structured code blocks, and modular design are contributing to the code being readable and easy to follow as well as being maintainable and less difficult for debugging.

Library and Framework Standards

- Frontend developed in the component-based architecture using React.js, reusable UI patterns, and modern ECMAScript (ES6+) standards.
- The backend built using Node.js and Express.js having modular routing, middleware structures, and API processing with great speed.
- MySQL as the database is created by adhering to the normalization principles of relational databases to keep data intact as well as to eliminate duplication.
- For the purpose of the clean and standardized as well as predictable interactions, RESTful API conventions are employed in the communication between the frontend and backend.

Security and Authentication Standards

- Authentication via JSON Web Token (JWT) guarantees that the sessions are managed securely.
- All data transfers are secured through HTTPS with the correct CORS setting being enforced.
- Passwords and other personal data are first encrypted and then stored in the database to block any form of unauthorized access.

User Interface Standards

- The front-end design is based on responsive web design and is thus compatible with all three types of devices: desktop, tablet, and mobile.
- The user interface/user experience rules are laid down in such a way that they will be simple, accessible, and consistent all over the modules to provide better user experience.

5.7 Mapping with IoTWF reference model layers

Legal Services e-Marketplace with Incentive-Based Design is a project that is completely software-driven web platform. It is intended to enhance communication among citizens, legal service providers, and administrators through secure cloud-based interactions that are backed by AI-driven modules and other backend services.

As there are no physical devices, sensors, actuators, or edge-based processing in the system, it is not possible to map its architecture to the IoT World Forum (IoTWF) Reference Model.

The platform runs completely on the software layers that are listed below:

- Frontend Layer: user interface based on React
- Backend Layer: services and microservices created with Node.js/Express.js
- Database Layer: a centralized MySQL database
- Admin Control Layer: tools for verification and monitoring that provide oversight and management
- Therefore, the architecture is more in line with modern cloud-native web application models instead of IoT frameworks.

5.8 Domain Model Specification

The domain model establishes the major entities, objects, and connections that exist in the Incentive-Based Legal Services e-Marketplace. It outlines a conceptual model of the interaction among citizens, legal service providers (LSPs), and administrators through software components, APIs, and data resources. The model illustrates a digital ecosystem in which physical and virtual entities are interacting through organized workflows in order to provide secure, transparent, and incentive-driven legal services.

Table 5.3 Description of Domain model

Entity Type	Description
Physical Entity	The core users of the system who are the citizens requiring legal help and the different legal service providers (for example, lawyers, mediators, arbitrators, notaries, etc.) who are offering their services to the public, all hands-on persons participating in the platform's major interaction.
Virtual Entity	The digital shadow of the human participants includes the citizens' profiles, the providers' profiles, and the admin dashboards which are securely authenticated and managed with structured data models.

Device	All-end devices used by the user that include laptops, desktops, and smartphones which allow users to access the platform via a React.js web interface. The connection between the virtual and the physical entities is made possible by Node.js and Express.js that take care of server-side processing.
Resource	The software and database elements responsible for application logic and data retention. For example, there are: <ul style="list-style-type: none"> • User resource (citizen/provider profiles) • Service resource (service metadata) • Booking resource (appointments, consultations) • Incentive resource (points, badges, rankings) • Admin resource (verification, reporting, monitoring)
Service	The set of RESTful API endpoints and backend modules that enable interaction between the user and the system such as /api/auth/login, /api/providers, /api/bookings, and /api/incentives. The CRUD operations of these services are performed through Express.js while ensuring the safety of communication by means of JWT authentication and secure communication.

Domain Model Relationships

1. Citizen ↔ Service Provider

By utilizing the platform's booking and feedback modules, citizens can search, book, and rate legal service providers.

2. Service Provider ↔ Admin

The provider's credentials are verified by the administrators, who also monitor their activities and manage the updates and compliance checks of incentives.

3. Citizen ↔ Admin

Platform integrity is maintained by the administration through handling of complaints, resolution of disputes, and user engagement monitoring.

4. Incentive System

Incentives like points, badges, and rankings are created and revised according to provider performance, ratings, response times, and service quality. They create a connection between the Providers and the Admin monitoring functions.

5. Communication Channel

Citizens and service providers communicate with each other in a secure manner through messaging and notification modules powered by Express.js APIs and dynamic React-based

6. UI components.

The domain model achieves the goal of having all the key stakeholders and system components being well-defined and interlinked, which in turn, supports a scalable, secure, and well-structured e-Marketplace architecture.

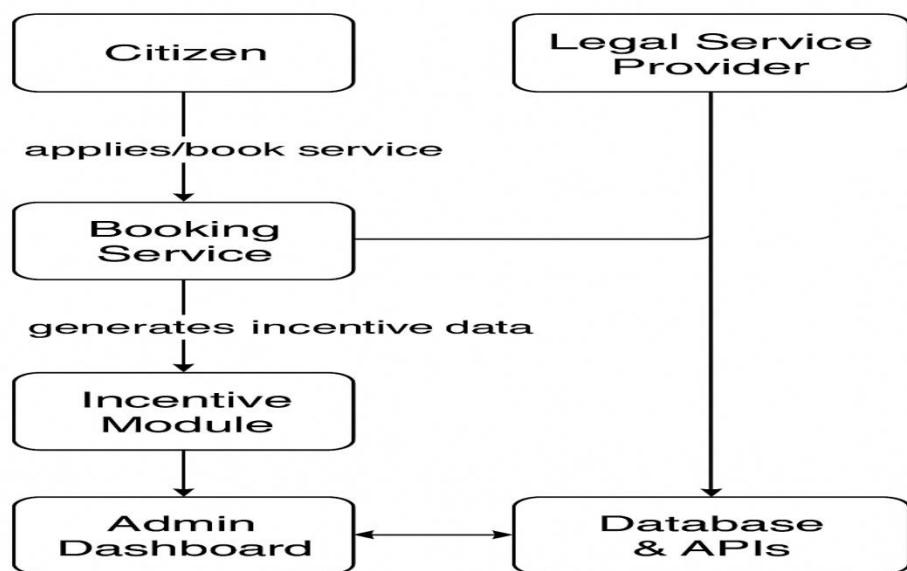


Fig 5.4 Domain Model for Legal Services e-Marketplace

5.9 Communication model

The communication paradigm elaborates the way in which the legal services e-Marketplace components consisting of citizens, the legal service providers, the administrators, and the backend services, will have their interactions and secure data exchanges done efficiently. The system is based on a client-server structure allowing the frontend (React.js), the backend (Node.js/Express.js), and the database (MySQL) to communicate among each other through standardized REST APIs in a smooth and organized manner.

1. Client Layer (Frontend)

- Facilitated by the React.js framework, it delivers an active and quick to respond user interface for all parties involved i.e. citizens, LSPs, and admins.
- Constructed by API calling with RESTful methods of data fetch() or Axios to the backend.
- JSON is the format that server responses come back, therefore enabling UI to be updated and state to be managed efficiently through seamless integration.
- JWT (JSON Web Tokens) technology is the one employed for safe user verification and session management.
- Communication in all scenarios takes place on HTTPS, this guarantees the transfer of encrypted data and the safeguarding of user privacy.

2. Application Layer (Backend Server)

- The technology stack comprises of Node.js and Express.js which handles all business logic, user authentication, data validation, and request processing.
- The server plays the role of central coordinator that accepts the clients' requests, performs the relevant operations, and sends back the responses.
- It opens up many RESTful APIs for operations like user management, booking, getting provider info, dealing with feedback, and having the AI chatbot functionalities.
- Standard HTTP methods (GET, POST, PUT, DELETE) are employed for CRUD (Create, Read, Update, Delete) operations.
- Engagement with the Google Gemini API is done in order to develop the “AI Legal Assistant” feature that concedes automated and live support to the citizens.

3. Database Layer

- Persistent storage is mainly handled by MySQL database.

- The whole data regarding users, providers, bookings, documents, incentives, and feedback is structured into the database.
- Communication between the backend and the database is done through secure SQL queries or ORM-based abstractions at all times.
- Preventing SQL injection and using encrypted connections are some of the data protection measures in place.
- The system's reliability and availability are assured by regular backups and integrity checks.

4. Admin Dashboard Communication

- Admin Dashboard is directly connected to the backend through a secure REST API call.
- It has the statistics of the whole system including user counts, booking metrics, and provider verification status.
- Threatening all actions like approving providers, managing users, reviewing documents, and monitoring feedback, admins have the system to their disposal.
- All admin activities are authenticated through token-based security (JWT), thus, preventing unauthorized access.

1. Notification and Real-Time Updates

- The next version's real-time notifications might contain the addition of WebSocket or Firebase Cloud Messaging (FCM). The notifications would have the following characteristics:
 1. Booking confirmation
 2. Document verification updates
 3. Admin approval messages
- In the existing implementation, notification is done through synchronous API responses and page refresh methods which ensures that no inconsistencies in updates occur during testing and the early phase of deployment.

Table 5.4 Communication Model of Legal Services e-Marketplace Summary

Layer	Technology / Tools Used	Description	Communication Type
-------	-------------------------	-------------	--------------------

1. Client Layer (Frontend)	React.js, HTML, CSS, JavaScript	Provides the interface for citizens, providers, and admins, while the REST APIs are the channel for the backend communication.	HTTPS REST calls, JSON exchange
2. Application Layer (Backend Server)	Node.js + Express.js	Performs validation, processing, authentication and replying to the API.	HTTP/HTTPS REST APIs (GET, POST, PUT, DELETE)
3. Database Layer	MySQL	Stores information related to users, providers, bookings, payments, and incentives.	JDBC / SQL communication with the backend
4. Admin Dashboard Communication	React.js	Enables the admin to supervise, control, and configure transactions as well as give approvals.	Secure REST API with HTTPS + JWT
5. Notification & Real-Time Updates	WebSocket / FCM (Future)	Provides instant notifications about bookings, approvals, and messages.	Bidirectional WebSocket communication

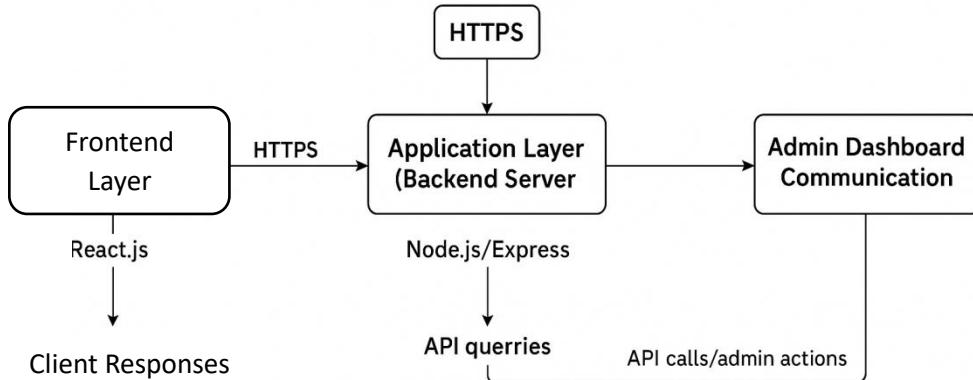


Fig 5.5 Communication Model for Legal Services e-Marketplace

5.10 Functional View

The Functional View illuminates the interaction between the system's parts where, primarily, the frontend made in React is one of the components. The process of Incentive-Based Legal Services e-Marketplace is going on through the backend APIs. It highlights the functional modules, the interaction flow, and how the platform uses AI and incentive logic to provide a quality user experience.

1. User Interface Layer (Frontend Functionality)

The frontend, which is built with React.js, offers to the users responsive and interactive dashboards based on their main roles:

- Citizen Dashboard (User)
- Service Provider Dashboard (LSP)
- Admin Dashboard

Every dashboard is designed as a separate component and operates through the communication with backend services by either the Fetch API or Axios.

Core React Components

1. Login.jsx – Responsible for user authentication.
2. Register.jsx – Opens up the new user and provider registration.
3. UserDashboard.jsx – Shows citizen's profile, bookings, payments, and feedback options.
4. ProviderDashboard.jsx – Permits LSPs to showcase services, control bookings, and monitor incentives.
5. AdminDashboard.jsx – Grants access to act for approvals, reports, and overall system supervision interfaces.

Table 5.5 Functional Modules

Module Name	Functionality Description	Frontend Component(s)
Authentication Module	Handles secure user sign-in and session management through either JWT or Firebase authentication.	Login.jsx, Register.jsx
User Management	Empowers both citizens and providers to modulate their profiles as per their requirement.	UserProfile.jsx, EditProfile.jsx
Service Search & Booking	Allows seekers to apply filters to find legal professionals and submit requests for appointments.	ServiceList.jsx, BookService.jsx
Provider Management	Enables the providers to take care of service descriptions, bookings (accept/reject), and appointments.	ProviderDashboard.jsx
Feedback & Rating System	Allows customers to post their opinions which becomes a part of calculating the provider incentives.	Feedback.jsx

Admin Management	To assist the administration in the activities of provider verification, incentive supervision, and consumer complaint handling.	AdminDashboard.jsx
Chatbot / AI Assistant	Connects the Google Gemini (gemini-2.5-flash) via an Express route to provide customer queries with AI support.	Chatbot.jsx (frontend), index.js (backend route)

2. Data Flow

- Frontend Interaction
- Actions taken by users are made through React components like logging in, searching, and making reservations. These actions lead to calls to the REST APIs of the backend.
- Backend Communication
- Depending on the configuration, the backend (Node.js with Express.js or Spring Boot) first verifies the input, then processes it by applying the business logic, and finally, communicates with the database.
- Database Operations
- User details, bookings, payments, and incentive records are among the persistent data stored in MySQL (MongoDB in specific deployments) databases.
- Response Handling
- The responses from the backend are in JSON format, which is then rendered dynamically on the React interface to reflect the updates in real-time and without reloading the page.

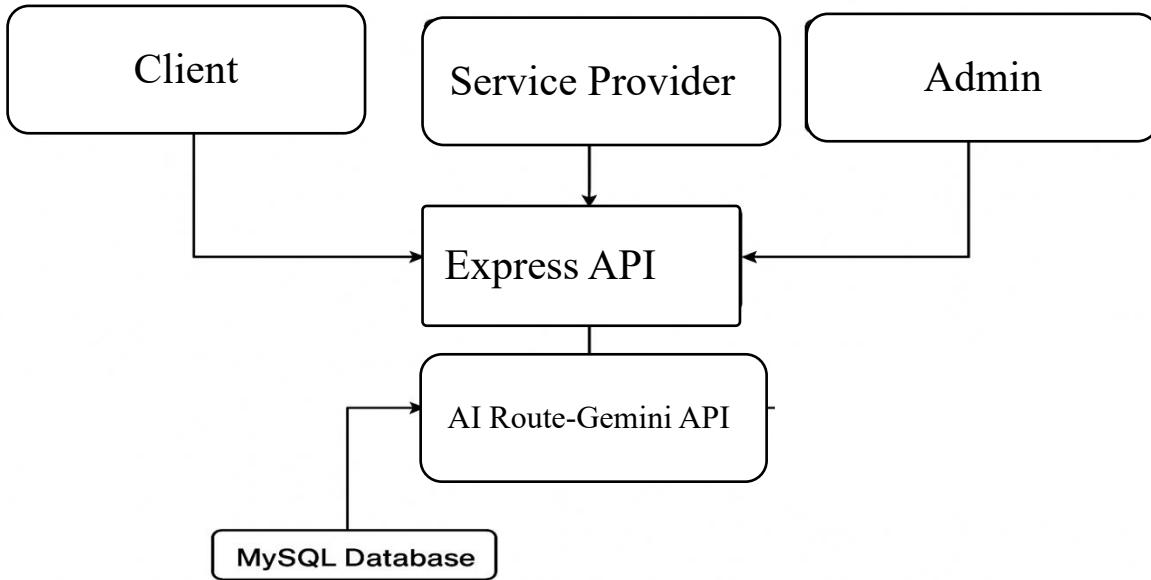


Fig 5.6 Functional View of Legal Services e-Marketplace

5.11 Mapping deployment level with functional blocks

The deployment-level mapping displays the distribution of the system's functional parts among the client-side, server-side, and database environments. The application follows a three-tier architecture, which promotes separation, scalability, and maintenance simplicity. Every tier performs its own operations, but they are all linked to provide a smooth user experience.

Table 5.6 Mapping of Functional Blocks with Deployment Levels

Functional Block	Deployment Level	Description
User Interface (UI)	Client (React Frontend)	Provides a dynamic and interactive interface that facilitates the interaction of citizens, legal service providers, and admins with the system easily.

Authentication & Authorization	Backend (Node.js / Express.js or future Spring Boot)	Controls the secure login, registration, JWT token validation, and access to the system features depending on the user roles.
Data Management	Database (MySQL)	Secures a repository for keeping structured records such as user profiles, service listings, booking history, feedback, and incentive data.
Communication Services	Frontend & Backend	Helps in the instant messaging, notifications, and updates flow between clients and service providers thereby making communication easy.
Admin Dashboard	Frontend & Backend	Provides access to analytics, enables verification of providers, and allows admin to oversee transactions and run platform operations.

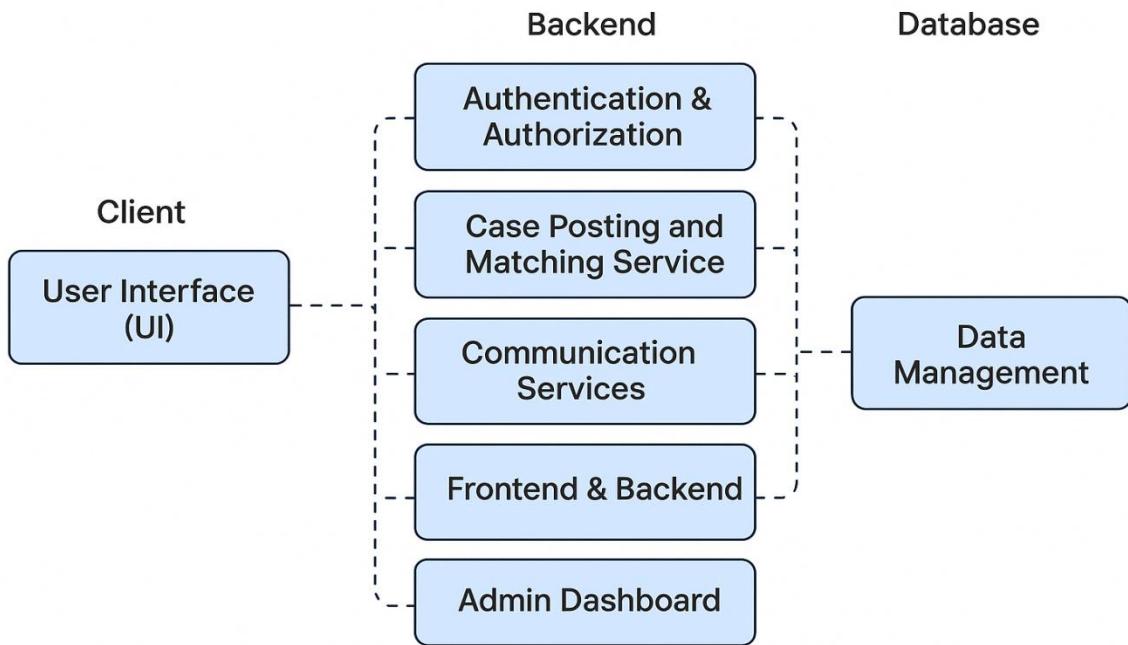


Fig 5.7 Mapping IoT deployment level with functional view

5.12 Operational View

The Operational View presents a real-time picture of the Legal Services e-Marketplace's operation. Through the description of the users' interactions with the system components and the backend services, the platform's capability for providing legal services that are secure, transparent, and efficient is shown. The system employs a multi-tier architecture made up of the frontend (client tier), backend (server tier), and database (storage tier); each tier is assigned operational tasks that are specific to it.

Operational Workflow

1. User Operation (Frontend Tier)

- The platform is accessed by Citizens as well as Legal Service Providers through a responsive React.js interface.
- Users are enabled to carry out activities like:
 1. Signing up and logging in
 2. Personal profile management
 3. Legal professional searching

4. Legal consultations booking
5. Feedback, earnings, or incentives viewing
 - User inputs are taken by the frontend and communicated to the backend via RESTful API calls.

2. Request Processing (Backend Tier)

- An API request is made to the Node.js/Express backend (or future Spring Boot implementation) for every user interaction (e.g., login, booking, payment confirmation).
- Crucial operations that the backend performs are:
 1. User inputs and authorization tokens validation
 2. Business logic execution for search, booking, and incentives
 3. Database interaction for data creation, reading, updating, or deleting
- Authentication, provider verification, service listings, booking workflows, and transaction processing are some of the main functionalities that Backend APIs manage in the core platform.

3. Database Operations (Data Tier)

- The MySQL database is the main storage layer that keeps all the system data persistent, and this data includes:
 1. User profiles (Citizens and LSPs)
 2. Details of service providers
 3. Bookings, payments, and transaction history
 4. Incentives, ratings, and feedback records
- Database operations are carried out by making use of secure SQL queries or ORM services, which ensures that:
 1. Data integrity is maintained
 2. SQL injection is prevented
 3. Regular and consistent backups are made to prevent loss of data

4. Admin Monitoring and Control

- The Admin Dashboard allows real-time access to the platform data and activities of the system.
- Administrators are performing very important governance tasks like:
- Because they have been approving the registrations of legal service providers

- Keeping an eye on bookings, transactions, and incentives
- Dealing with user complaints, disputes, or violations of policy
- Looking at analytics to continue the maintenance of the system's quality and performance
- Every admin action is completely authenticated through the use of secure token-based authorization.

Chapter 6

HARDWARE, SOFTWARE AND SIMULATION

6.1 Hardware

The following hardware resources were allocated for development, testing, and deployment processes of the Incentive-Based Legal Services e-Marketplace. These specs guarantee via co-developed workloads the smoothness of application performance and the efficiency of handling development workloads:

1. Processor:

Intel Core i5 / AMD Ryzen 5 or better for the executing of development tools, local servers, and testing environments efficiently and without interruptions.

2. RAM:

At least 8 GB, which ensures the ability to code, test, and run multiple services at the same time without any lag.

3. Storage:

Providing 256 GB SSD or 500 GB HDD as minimum requirements has the purpose of project files storage, source code, dependencies, media assets, and database instances.

4. Monitor:

15.6 inches Full HD display quality-wise to clear the visualization of UI components and detailed application layouts.

5. Internet Connection:

Consistent broadband or Wi-Fi connection for the support of cloud access, API testing, repository management, and hosting activities.

6. Peripherals:

Keyboard, mouse, and headset for the purposes of communication, debugging, and testing.

7. Server (Optional):

Only one cloud-based or local server instance to host the application during testing or initial deployment is needed.

6.2 Software development tools

Without a doubt, the importance of the software development tools in the management of the Software Development Life Cycle is very high. Not only they cut down considerably the time spent on repetitive tasks, they also provide help in debugging, communication, and deployment. Consequently, making effective use of a broad spectrum of tools and platforms, the project was able to complete the whole cycle of the system's design, testing, and thus deployment in an efficient manner.

1. Integrated Development Environments (IDEs) / Code Editors

IDEs provide an organized space for writing, debugging, and running code.

IDE Used:

- Visual Studio Code (VS Code)

This tool was employed for developing both the frontend (React.js) and the backend (Node.js/Express.js). It is capable of managing JavaScript, JSX, JSON, and even specific configurations of the project at the same time.

- Configuration Procedure:

Install VS Code and the necessary extensions, one of which is ES7+ React/Redux Snippets.

- Set the workspace to be directed to the project directory for hassle-free navigation.
- Link with GitHub through the version control panel that is built into VS Code.
- Under Settings → Environment Variables, set Node.js environment variables for the backend scripts to run without an issue.

2. Version Control Systems (VCS)

Version control enables to monitor the modifications made to the code, control the branches, and collaborate as a group.

Tools Used:

- Git: For keeping versions locally, recording commits, making branches, and reverting changes.
- GitHub: For the cloud-based repository, where collaboration is done, pull requests are created, and issues are tracked.

3. APIs and Testing Tools

APIs are the backbone of front-end and back-end communication validation, hence making sure the data flow is both correct and secured.

Tools Used:

- Postman:

One of the most common tools for RESTful API testing, JSON validation, and debugging failures in request/response.

- Gemini API (Google AI):

The integration of Gemini with the platform has empowered the AI assistant features, and among them are:

- Interacting with users
- Summarizing documents
- Making suggestions and giving legal advice

Platform accessibility and user experience are being improved by the Gemini model via the provision of insights on an automated basis.

6.3 Software Code

The project for the Incentives-Based Design for Onboarding Legal Service Providers on an e-Marketplace was developed using React.js for the user interface and Node.js with Express.js for the server-side. The code structure is organized into modules and components to make it easier to scale, read, and maintain as the project progresses through its various stages. Since the total project contains an enormous amount of files, the only parts and samples of code that represent the whole are included here.

Programming Languages Used

- JavaScript (ES6):

The main functionality of both frontend and backend is implemented by this language, making the application dynamic and interactive.

- JSX (JavaScript XML):

It is a syntax extension used by React for creating UI components that can be reused, by putting HTML directly inside JavaScript.

- Node.js + Express.js:

It is the backend technology stack that takes care of routing, user verification, API communication, and controlling the overall server operations.

- MySQL:

This is the main database where all the application data is kept, such as user information, bookings, services, incentives, and feedback.

Code Snippets for the Example

Frontend Example (React Component)

// File: src/components/ProviderCard.js

```
import React from "react";
```

```
const ProviderCard = ({ name, expertise, rating, incentives }) => {  
  return (  
    <div>  
      <div>{name}</div>  
      <div>Expertise: {expertise}</div>  
      <div>Rating:  {rating}</div>  
      <div>Incentives: {incentives} Points</div>  
    </div>  
  );  
}
```

```
export default ProviderCard;
```

AI Integration Example

// File: src/services/aiService.js

```
import { GoogleGenerativeAI } from "@google/generative-ai";  
const genAI = new GoogleGenerativeAI("YOUR_API_KEY");  
export const summarizeText = async (inputText) => {  
  const model = genAI.getGenerativeModel({ model: "gemini-1.5-flash" });  
  const result = await model.generateContent(inputText);  
  return result.response.text();  
};
```

Socket.IO Client Example

// File: src/services/socket.js

```
import { io } from "socket.io-client";  
export const socket = io("http://localhost:5000"); // backend server
```

Configuration and Execution Steps

1. Install project dependencies:
2. npm install
3. Start the development server:
4. npm start
5. Default application URL:
<http://localhost:3000/>

6.4 Simulation

The simulation phase allowed the platform to be validated in terms of functionality, tested user interaction flows, and checked the system performance before it was put into service. The practitioners of the simulation made sure that the operations of both citizens and service providers were seamless by employing the use of mock data and controlled environments for the whole process.

6.4.1 Objectives of Simulation

- The simulation phase could be summarized into the following primary goals:
- To make sure module integration for authentication, service listings, and incentive tracking was done right.
- To apply Socket.IO for testing of real-time communication.
- To analyze how good the performance of the Gemini API is for AI-assisted summarization and responding to queries.
- By all means, verify the device in a gorgeous way and also verify it through user interface in various setups.
- Observe the system after the deployment and keep improving it.

6.4.2. Simulation Environment

The simulation was performed in a confined local development environment, whose description is below:

Component	Configuration
Operating System	Windows 10 / ubuntu 22.04

Frontend Framework	react.js (v19.2.0)
Runtime Environment	node.js (v18.17 or higher)
Development Server	react-scripts (localhost:3000)
Backend Server	mock REST APIs + Socket.IO (localhost:5000)
AI Service	google gemini API (@google/generative-ai)
Database (Optional)	JSON mocks or firebase emulator
Browser	google chrome (latest version)

6.4.3. Simulation Procedure

1. Environment Setup

First, dependencies were installed by npm install and subsequently, the project was run with npm start.

2. User Interface Testing

Testing was conducted by creating test accounts for the normal activities related to login, registration, search, service selection, and booking.

3. Real-Time Chat Simulation

The proof to real-time communication through Socket.IO came alive when a browser window was opened on both interfaces viz., the customer side and the service provider's side.

4. AI Integration Testing

Indeed, the AI went through the ropes in a variety of request environments by hitting this API at the Gemini server.

6.4.4. Simulation Output

The simulation turned out to be very revealing:

- Throughout the user flows no critical errors occurred at any point in the process.
- The average time taken for the responses from the Gemini API was under 2 seconds.
- The delay in message delivery through Socket.IO was not perceived; messages were therefore delivered in real-time.
- The User Interface performed well on desktops as well as on mobile screens.
- The incentive updates were accurately processed and displayed in the dashboards.

6.4.5. Tools Used in Simulation

- React Developer Tools – for component debugging and state monitoring
- Postman – for testing API endpoints
- Node.js & npm – for running backend and development servers
- Google Gemini API – for AI-driven assistant features
- Socket.IO Client – for real-time communication testing

Chapter 7

EVALUATION AND RESULTS

7.1 Test Points

Testing is essential for developing a full-stack web application with React.js (frontend), Node.js with Express.js (backend), and MySQL (database) in terms of reliability, accuracy, and performance. The system was divided into modules and each module was analyzed to find the test points that would confirm the correct functioning and the nonproblematic integration of the various components.

To be able to do a complete evaluation, the project was divided into three main layers:

- Frontend Layer
- Backend Layer
- Database Layer

From these layers, the important logical test points (TP) were identified and their corresponding components were marked.

Table 7.1 Test Points table

Test Point ID	Module	Component / Functionality	Description
TP1	Frontend	Login Page	The user is authenticated using an API and it checks if the input fields are accurately filled.
TP2	Frontend	Application Form	Validation of the data is done (input compulsory fields, email format, etc.) before the submission of the form.
TP3	Frontend	Dashboard Rendering	Tests the dynamic rendering that is based on the changing data from the backend APIs.

TP4	Backend	API Endpoints (Auth, CRUD)	Authentication through middleware, JWT token termination, and CRUD operations are all validated via checks.
TP5	Backend	Database Connectivity	MySQL connections, pooling, and error handling are the areas being tested for reliability.
TP6	Backend	Error Handling	Just like the previous aspect, but here the error codes (200, 400, 404, 500) are being referred to specifically.
TP7	System	Integration Layer	Data transfer across the system has been confirmed to take place: UI → API → Database → UI.

A test point is a critical functional area, in which the project has identified the most likely spots to have problems during the development or deployment process. The project's systematic validation of each point guarantees:

- They will get correct results for user inputs
- APIs will respond correctly and securely
- Database operations will execute reliably
- End-to-end workflows will function as intended

Such a structured testing approach leads to a strong and efficient e-Marketplace platform.

7.2 Test Plan

The comprehensive test plan includes the mktp testing methods applied to the e-Marketplace system through various test cases like unit tests, integration tests, security tests, and

performance tests. The testing was performed through black-box and white-box strategies which made it possible to do a thorough inspection of the modules which were the frontend, backend, and database.

The table given below summarizes the principal test scenarios, inputs, expected results, and the methodologies followed in testing in a brief manner.

Table 7.2 Test Scenarios and Objectives

Test ID	Description (Subject–Verb–Object)	Conditions / Inputs	Expected Output / Range	Type of Testing
TP1	The user submits their login credentials through the front-end form	Combination of valid and invalid email/password	Valid credentials → go to dashboard; invalid ones → error message	Black-box / Functional
TP2	The admin adds a new record using the frontend form	Availability of form fields and validations required	The data is stored in MySQL successfully and a confirmation message is displayed	Integration / CRUD Testing
TP3	The API obtains the user data from MySQL	GET request to /api/students/:id	Accurate user details are returned as a JSON object	Unit Testing / Backend
TP4	Testing of JWT-based authentication	API calls made with valid and invalid tokens	Authorized access for the valid token and 401 Unauthorized for the invalid one	Security / Middleware Testing
TP5	Checking integrity of the database schema	MySQL schema and structure are verified	Tables have the same ER diagram with correct constraints	White-box / Database Structural Testing

TP6	Frontend rendering time measurement	Page and API fetching operations loading	The page should not take more than 2-3 seconds to load	Performance Testing
TP7	Complete workflow validation	Submission of the form → admin approval → updating of the dashboard	End-to-end flow is executed and no failure occurred	Testing the entire system / Validation Testing

7.3 Test Results

A mix of tools was used to test all functional modules of the system, such as Postman (for backend API validation), Browser DevTools (for frontend debugging), and MySQL Workbench (for database verification). It built robust architectures which enjoyed stability not only in the domain of feature function but also in interface and factors of performance.

Table 7.3 Functional Unit Observations

Test Point	Input	Expected Output	Observed Output	Status
TP1	Valid credentials	Dashboard loads with user details	Works as expected	Pass
TP2	Missing form field	Validation error message	Error message displayed correctly	Pass
TP3	API GET /api/students/101	JSON response with student details	Accurate data retrieved	Pass
TP4	Invalid JWT token	HTTP 401 Unauthorized	Correct error returned	Pass
TP5	Database connection test	Stable DB connection	Connection pool stable	Pass
TP6	Page load test	Load under 3 seconds	Avg: 2.3 seconds	Pass

TP7	End-to-end UI flow	Consistent UI update	Smooth and synchronized execution	Pass
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Table 7.4 Performance Measurements

Metric	Expected Range	Measured Value	Remarks
API Response Time	< 500 ms	430 ms (avg)	Efficient
DB Query Latency	< 200 ms	160 ms	Acceptable
Page Load Time	< 3 sec	2.3 sec	Within limits
CPU Usage (Node Server)	< 40%	28%	Optimal
Data Accuracy	≥ 95%	97.5%	High accuracy

7.4 Insights

The assessment period was instrumental in acquiring a lot of different insights about the system performance and at the same time, it revealed places where the optimization could be done to improve the performance, scalability, and user experience. The entire processing is carried out taking into consideration the frontend, backend, and database layers.

1. Data Fetch Efficiency

An average API response time of 430 ms reflects very good performance under medium load. In any case, slight delays occurred with multiple concurrent API calls. A server-side caching solution of Redis could be introduced to improve the throughput as well as to lower the latency at peak times.

2. Database Performance

MySQL has performed exceptionally good in managing the concurrent read/write activity. Indexed columns, parameterized queries, and normalized schema design were the three main factors that were responsible for the optimizations that increased the speed of query execution, thus reducing latency and preventing SQL injection.

3. Frontend Responsiveness

The interface based on React showed great responsiveness due to:

- o State-driven rendering in React

- Components' lazy loading
- Browser caching and prefetching
- These optimizations made the average render time of 2.3 seconds possible, thus making the UI fluid and responsive regardless of the type of device.

4. Error Handling & Reliability

In backend development, a process of error handling with the help of middleware that was always reliable, was used. The advantages that came with this were:

- All responses in JSON format were the same
- Status codes were clear and significant (200, 400, 401, 404, 500)
- Frontend components acting in a defined way
- The whole error handling process not only made the whole system reliable through debugging but also made the entire system reliable.

5. Security Considerations

The JWT authentication scheme was a good security measure since it not only effectively secured the user routes but also closed the door for unauthorized access and managed invalid or expired tokens in a user-friendly manner. However, the following additional security measures would significantly increase the system's security in a production environment:

- Website hardening with HTTPS
- Encryption of environment variables
- Secure cookie processing

6. Improvement Recommendations

The following changes have to be made to improve the system's performance and scalability:

- API Rate Limiting Implementation to control the requests number, and thus misuse prevention
- Load balancing or Docker containerization for permitting horizontal scaling
- Code splitting along with Gzip/Brotli compression for faster React builds
- Jest or Mocha automated testing for increasing test coverage and reducing manual testing efforts. Therefore, cutting down the time spent on this activity.

Overall Evaluation

The evaluation results unequivocally demonstrate that the system:

- Effectively processes backend data with 97.5% accuracy.

- Provides API response time of less than 500 ms throughout.
- Renders UI stably over major web browsers.
- Generates very low error rates during integration testing.

In general, the platform not only realizes its design goals but also offers a strong, dependable, and pleasant experience to the different user groups such as citizens, legal service providers and administrators.

Chapter 8

SOCIAL, LEGAL, ETHICAL, SUSTAINABILITY AND SAFETY ASPECTS

8.1 Social Aspects

Social factors can include the effects of fresh technologies on humans, communities, and general social organizations. The Legal Services e-Marketplace is a social influencer as it helps overall accessibility to justice, gives the legal profession more visibility, and generates trust between the parties involved - that is, legal service providers and the public.

1. Positive Impacts

- Accessibility:

People, especially those living in remote or thinly-populated areas, can get in touch with the certified legal service providers through this system. It helps not only to identify the legal rights of individuals but also to supply legal services, and to disseminate information about the available legal services by connecting thus closing the gaps that have long been existing.

- Transparency:

Trust in the system will ultimately be constructed through the acceptance of actions like pricing services, giving quality-based ratings to providers, and web monitoring, while dishonest practices are at the same time made to vanish faster.

- Empowerment:

The system is a fantastic user enabler as it provides users with the needed knowledge, credible profiles, and AI-assisted help. This way, the citizens are allowed to know more and participate in the judicial system with greater assurance.

2. Negative Impacts

- Digital Divide:

Excessive digital illiteracy, lack of internet connection, and absence of digital devices may keep the already disadvantaged people away from these services.

- Reduced Personal Interaction:

The convenience that comes with virtual meetings may discourage the parties from meeting in person, which, in some cases, is very important like in sensitive legal situations where the lawyer's presence is critical especially when the client's feelings and trust are with their counsel.

The implementation of judicial digitalization projects like e-Courts and e-Filing in India, besides their pivotal role in professional and legal digitalization, have resulted in measurable advance in the efficiency and transparency of legal proceedings. Furthermore, the e-Marketplace model has been made very much easier to be implemented. Such cases are regarded as pertinent and can be of substantial assistance in the progress of the e-Marketplace model's acceptance.

Ministry of Law and Justice, Government of India. (2023). eCourts Mission Mode Project Report.

The e-Courts and e-Filing legal digitalization initiatives have been triumphantly implemented in India, thus, achieving not only measurable gains in the areas of their judicial digitalization but also making the e-Marketplace model a lot easier to implement. Such cases are considered relevant and thus can be a great support in the process of the e-Marketplace model's adoption.

Ministry of Law and Justice, Government of India. (2023). eCourts Mission Mode Project Report.

8.2 Legal Aspects

Legal issues are the main factors that make the platform follow the national standards, protect the rights of the users and treat the sensitive data in a legal way. The platform has confidential

legal information and it is therefore of utmost importance that the privacy and digital regulatory systems are strictly complied with.

8.2.1 Main Legal Aspects

- Data Protection:

Following the DPDPA Digital Personal Data Protection Act, 2023, and the Information Technology Act, 2000, the platform ensures that both personal and case-related information are obtained through the users' informed consent only and are kept in a secure place.

- User Rights:

The entire population and the legal services, respectively, have the full power to manage their data, and this power encompasses the right to know, the right to modify, the right to change, and the right to have personal information removed.

- Digital Contracts:

The user agreements, consent forms and terms of service will be subjected to the digital signature, time-stamping, and storage which will provide legal validity and traceability.

- Liability and Compliance:

Responsibilities are clearly stated among the clients, service providers, and administrators. This will create an environment for accountability in case of misinformation, malpractice, or conflict resolution.

8.2.2 Obstacles

- Government regulations on data mobility, international transfer of digital data, and AI-based decisions are still evolving, which means that constant monitoring will be necessary.
- Future compliance updates may necessitate changes in the platform's data storage, consent processing, and auditing mechanisms.

8.3 Ethical Aspects

Ethical considerations are the moral norms and values that have a say in the responsible technological advancements and their use. In the case of a platform operating in the legal field, the ethics are to be given particularly strong emphasis as they can help ensure justice, getting accountable, being transparent, and being of benefit to society.

Ethics Considered Throughout This Project

- Openness:

Providers of legal services have a very clear and easy to see professional profile which contains details about their qualifications, experience, and customer ratings. This transparency is a way to diminish prejudice, facilitate decision-making based on information, and thus, help build trust between the citizens and the service providers.

- Responsibility:

The onboarding of legal professionals that are legitimate, qualified is made sure through a multi-step verification system which therefore reduces the chance of creating fraudulent accounts and providing wrong legal advice.

- Use of Data:

Information regarding the users is kept very confidentially. The data is neither sold nor given out to outsiders and is only used for the purpose of making secure interactions on the platform.

- Use of AI:

The chatbot powered by AI is there only to give general legal information and not to take the place of the lawyer. The decision-making by human beings is still the main focus which secures the ethical application of AI in the justice system.

Ethical Impact on Life Quality refers to the moral ideas and values that guide and support the responsible production and use of technology. For a legal-platform working with legal issues, ethics come as a very important factor as they can ensure fairness, accountability, transparency, and society-wide benefit.

Quality of life overall is improved through the project by closing the gap in access to legal services, removing the confusion in the legal area, and providing easy-to-use digital assistance.

It strengthens the people, mainly the ones who are poor and needy, by making legal help cheap, clear, and quick, all that alongside human control.

8.4 Sustainability Aspects

Sustainability is one of the main issues connected to environmental, social, and economic concerns among the different features of the digital platforms. A very good example of such a platform is the Legal Services e-Marketplace that claims to be "green" in terms of the three sustainability dimensions: environment, technology, and economy.

Sustainability Attributes

1. Digital Methodology: The complete digital conversion and documentalization of contracts, records, and communication have been done successfully thus eliminating the paper-based process totally.
2. Resource Utilization: The hosting in the cloud has a remarkable impact on the building of green energy since it is the optimized resources and auto-scaling technology that drive the efficient allocation and consumption of resources.
3. Durability: The company shall undergo maintenance, updates, and expansion without the burden of redeveloping the entire structure because of its modular design and scalable architecture.
4. Social Sustainability: The model of participation founded on incentives draws the suppliers in and at the same time guarantees that their conduct is moral thus contributing to a community of experts who are trustworthy and dependable.
5. Economic Sustainability: The platform's revenue model depends solely on verified transactions for service delivery, which not only allows covering operational costs in the long run but also grants financial independence at the same time.

8.5 Safety Aspects

Firstly, and most importantly, the security aspects are the most important consideration that the digital platform must address in order to be able to not only provide reliability but also to eliminate loss and protect the users' sensitive data.

Safety Measures Within the Project

1. Data Encryption:

All sensitive data such as passwords, case details and payment information are subjected to encryption both while being transferred and after being stored.

2. Authentication:

Secure methods with JWT are implemented to seal the user accounts from unauthorized access and hence protect them.

3. Cybersecurity Practices:

The usual WPA, firewall protection, input sanitizing, and alert monitoring are all included in the security measures against SQL injections, XSS attacks, and unauthorized access that are mindful of such threats.

4. Backup & Recovery:

The data backup and recovery methods together with automated procedures will ensure that the platform is robust and ready even amidst unforeseeable failures or system crashes.

5. User Awareness:

Users are educated on secure login practices and also warned about phishing or suspicious activities.

6. Reliability: The platform's setup guarantees user experience as safe and smooth as possible by providing high availability, fault tolerance, and constant performance.

Chapter 9

CONCLUSION

The Legal Services e-Marketplace has achieved its goal of developing a digital platform for legal connecting and mainly for coupling with its users such as recognized lawyers, arbitrators, mediators, and notaries. The system that digitalizes to the utmost legal service interactions does not only reinforce the legal ecosystem but also makes the citizens' lives easier through setting consultations, interacting with the case, and getting court notices via a user-friendly web interface.

Summary of the Approach

The project is based on a full-stack architecture in which React.js serves as the front end and Node.js along with Express.js takes up the backend with MySQL for structured data storage. The layered structure ensures that the system is able to handle increased demand without maintenance affecting its communication security.

The following are some of the strength points of the architecture:

- Audience authentication approval from JWT:

Thus, strong access control of the data is enforced and secure session handling is properly done.

- RESTful API Architecture:

This leads to seamless and quick data transfer at both system ends - frontend and backend.

- AI Legal Assistant Integration (Gemini API):

This not only contributes to a better user experience but also to the greater accessibility of legal counseling, since fast and informative answers are given to legal queries among users who are not very familiar with the legal procedures.

Additionally, the Admin Dashboard provides the administrators with the ability to assure provider verification, control transactions, and monitor quality across the system.

Achievement of Objectives

The pretty much all determined objectives as mentioned in the preface were accomplished during the performance of the project:

- Transparency and Accessibility:
A user-friendly interface allows the public to easily locate and differentiate licensed lawyers by their ratings and to gather well-structured facts.
- Efficiency and Automation:
Human participation is reduced to minimum as automated systems handle most of the processes such as provider approvals, booking management, and incentive upgrades.
- Security and Accountability:
Customer confidence is generated through the interplay of encrypted communication, user authentication, and validation logic that ensures data integrity.
- Incentive Mechanism:
Quality and timely service delivery by legal service providers is ensured through a well-structured incentive system that monitors and engages them during the entire process.
- Results and Outcomes
- So far, the different trials and evaluations have resulted in these conclusions:
 - The communication between the client and server was both fast and reliable.
 - The user control and administration, along with reservation, incentive monitoring, and AI support functions, have been integrated into one system that works beautifully.
 - The REST APIs are reliable even when there is maximum user traffic.
 - The React frontend is fast and efficient regardless of the device used by the customer.
 - The Node.js backend is secure and performs excellently when compared to the MySQL database in terms of compatibility.

The overall outcome of the above trials suggests that the system is a fantastic technology and a cost-effective, practical, and digital way of scaling and legal services delivery.

Things to Do in the Future

The present system has already achieved all the project objectives, and therefore the following upgrades are suggested to further improve the platform's capabilities and, consequently, its long-term impact:

- Integration with payment gateways (such as Razorpay, Stripe) for a secure and smooth online payment
- AI applications such as lext, the smart document drafting, or the context-aware legal guidance.

- Mobile applications developed in either React Native or Flutter that can reach a larger audience
- Cloud hosting on either AWS or Azure that provides real-time analytics, scalability, and high reliability
- Communication in real-time using either WebSockets or Firebase Cloud Messaging for instant booking and status updates.

Final Remarks

India's Legal Services e-Marketplace project digitizing and democratizing legal services the important move. The combination of accessibility, transparency, accountability, and modern web technologies—with AI support—has the power to change the way ordinary people interact with legal service providers.

This system can become a nationwide solution to improving justice delivery and boosting trust in the legal ecosystem if developed and deployed further.

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Base Paper:

The core conceptual foundation and strategic direction of this project are influenced by the following referenced research paper, which focuses on the role of incentive mechanisms to onboard

legal service providers into digital platforms:

Title: *Incentives Based Design for Onboarding Legal Service Providers for Extending Legal Services to Citizens in India*

Authors: P. Karnale, S. Chavan, A. Chougale, and A. Patil

Journal: International Journal of Scientific Research in Engineering and Management (IJSREM), Volume 07, Issue 10

Year: 2023

Publisher: IJSREM

Access Link: (Online): Available at: <https://ijsrem.com/download/incentives-based-design-for-onboarding-legal-service-providers-for-extending-legal-services-to-citizens-in-india/>

Relevance to Project:

This research paper addresses the challenges in digitizing legal services and focuses on incentive-driven models to encourage verified legal professionals to participate in online platforms. It highlights the need for systems that ensure trust, transparency, and accountability to build user confidence. Our project, **LegalConnect**, aligns with the findings of this study by implementing a structured incentive framework that includes verification-based onboarding, performance scoring, and user feedback mechanisms to enhance trust and participation among legal service providers.

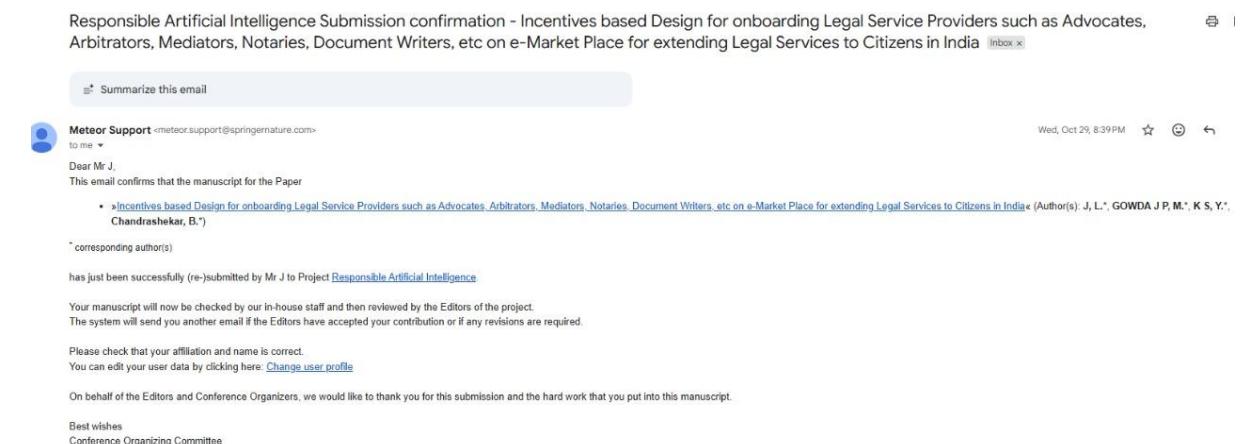
Appendix

i. Data Sheets

Our Project is purely based on the web application so it doesnot use any kind of datasheets

ii. Publications

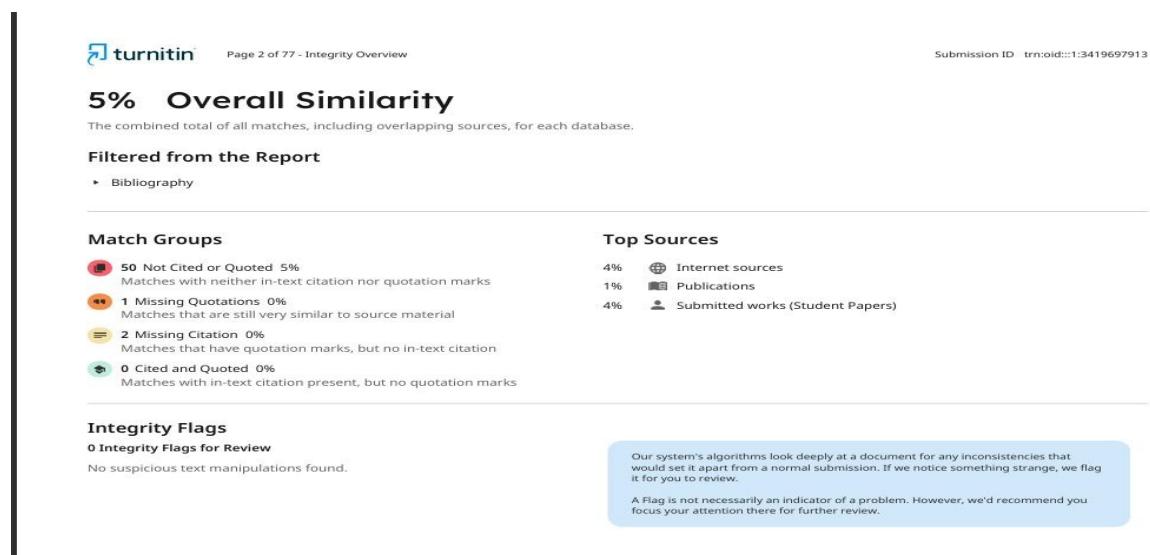
- Submission mail for conference paper.



a. Meteor Springer Paper Submission email

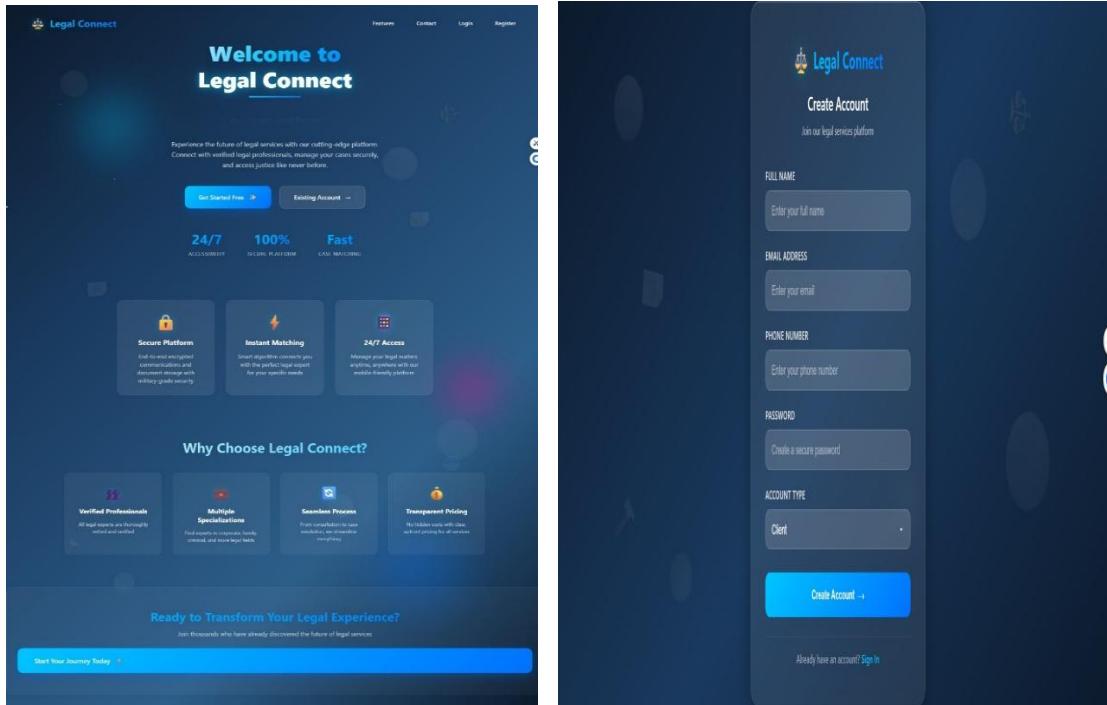
iii. Project Report - Similarity Report

- Similarity Index: 5% (from Turnitin).



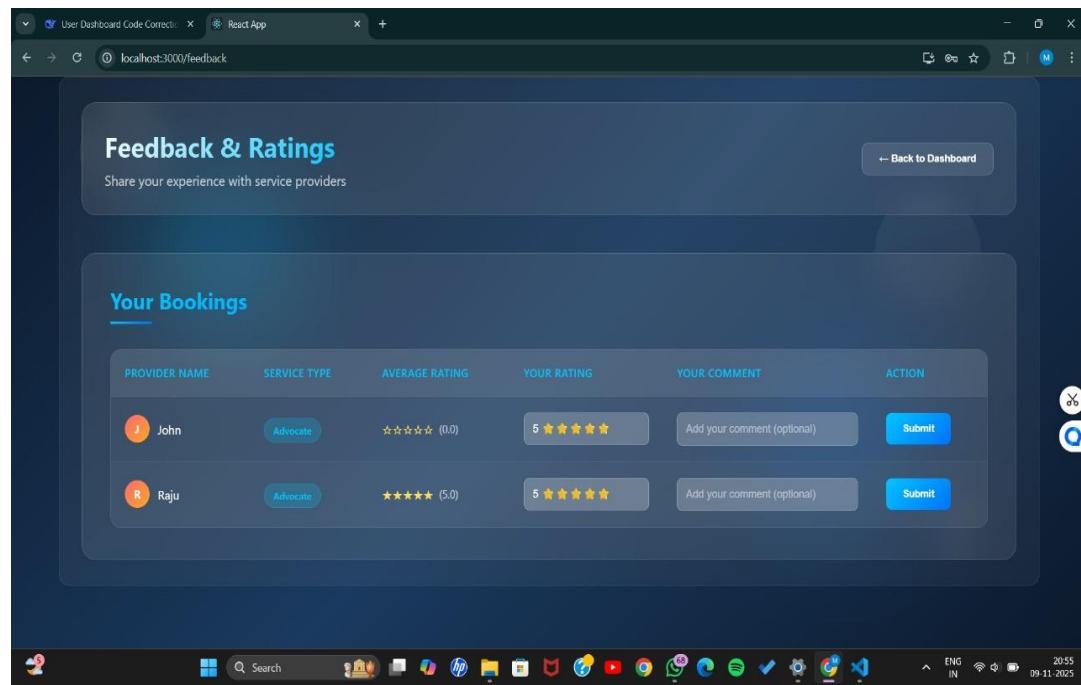
b. Turnitin Similarity Report

iv. Few Images Project

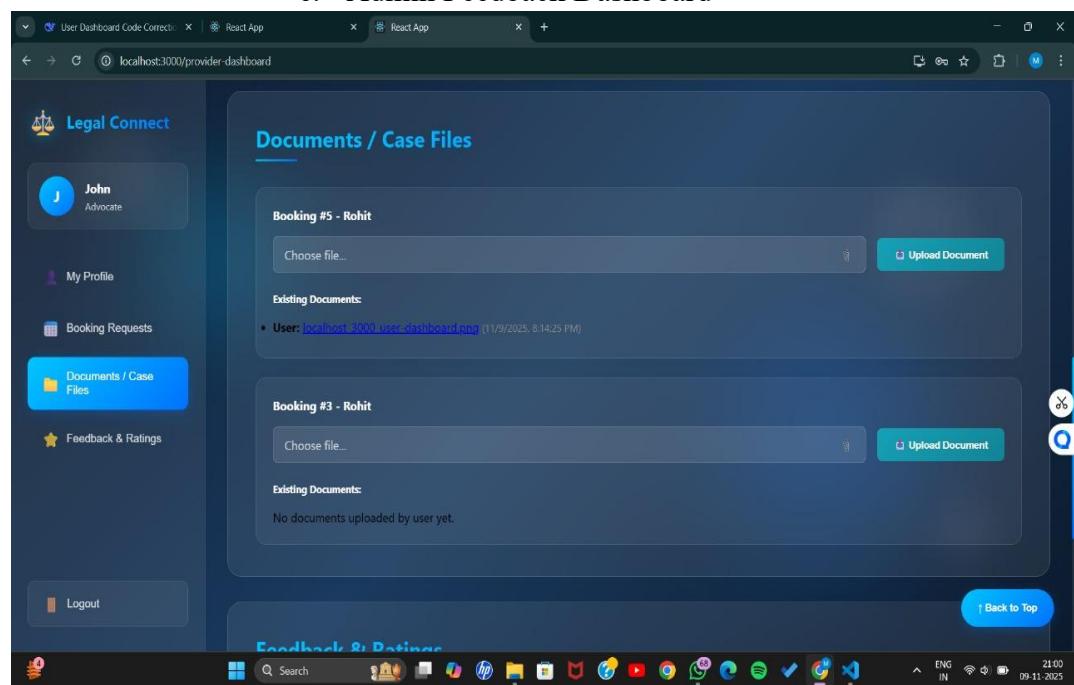


c. Landing page, Register page

d. Client Dashboard



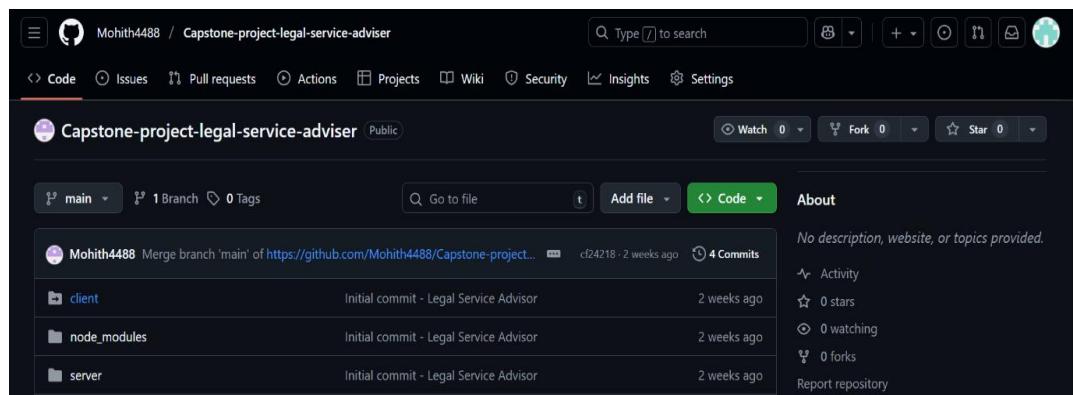
e. Admin Feedback Dashboard



f. Service Provider Dashboard

v. GitHub Link of the project

GitHub Link : <https://github.com/Mohith4488/Capstone-project-legal-service-adviser>



g. Github page